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N. E. ISHLONDSKY

ARTIFICIAL REJUVENATION AND VOLUNTARY CHANGE OF SEX

According To Professor Steinach

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Dr Henry Penn

N. E. Ishlondsky

Artificial Rejuvenation *And* Voluntary Change *Of* Sex

According to

Professor Steinach

Translated by

Henry S. Penn, M. D.

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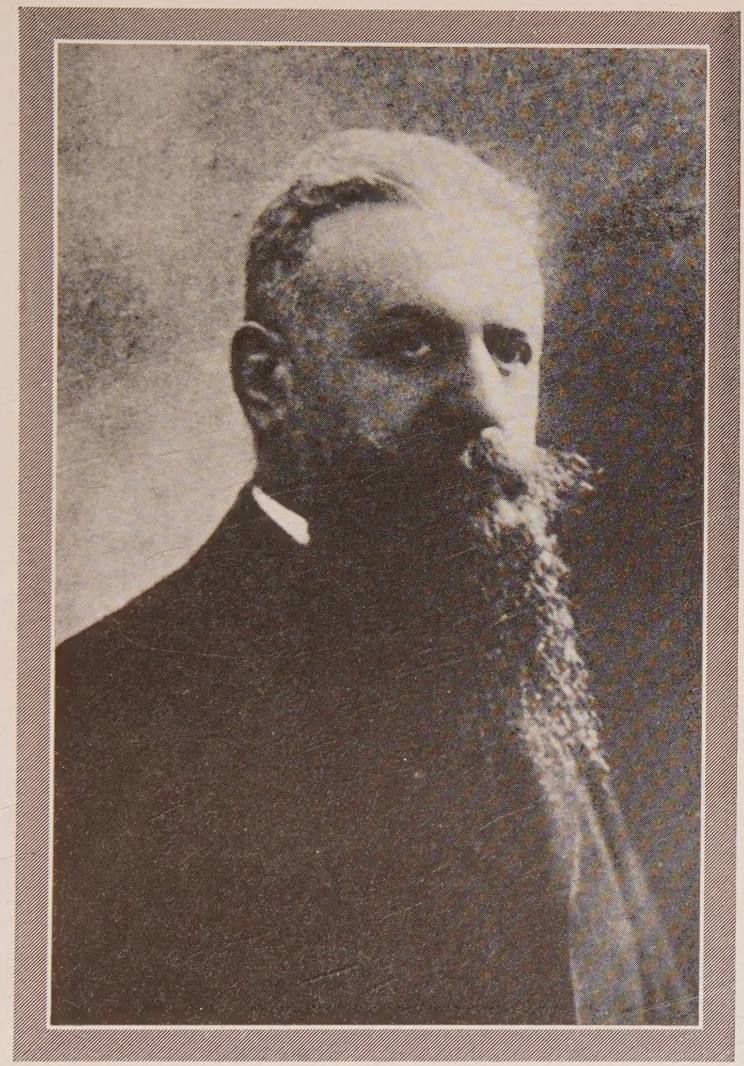
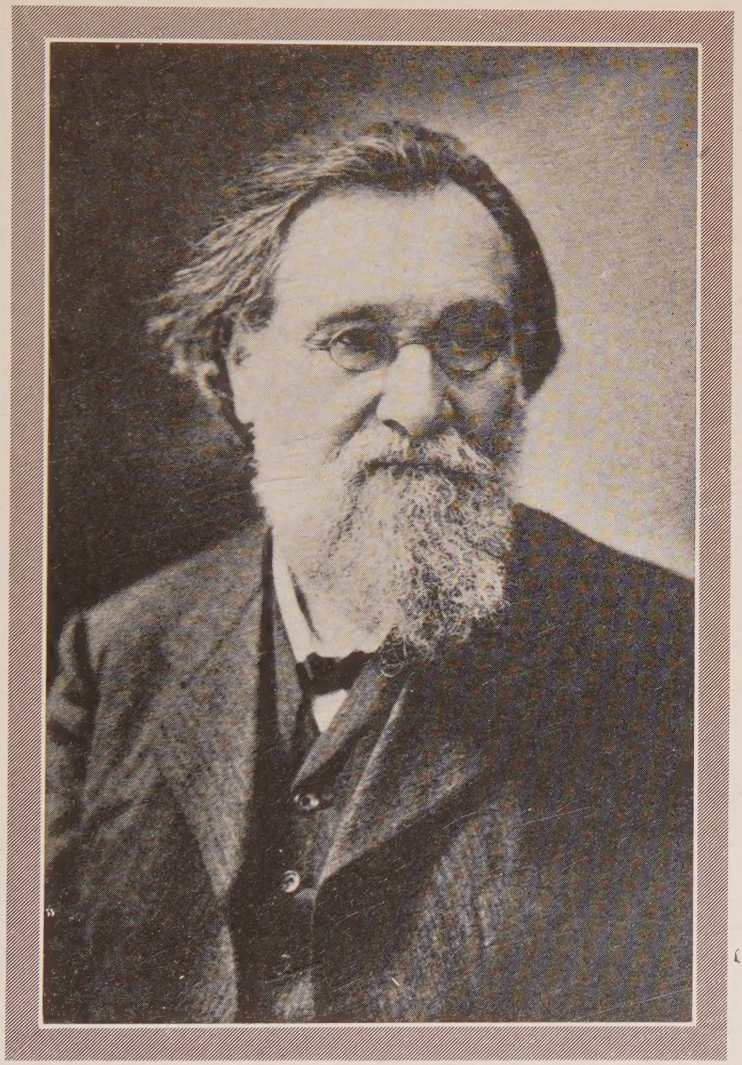


E. Steinach

This work
I Dedicate to my
Dear Mother

N. E. Ishlondsky



Wm. Mennuchs

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TRANSLATORS PREFACE.

Few scientific discoveries in medical history have met with so much mingled praise, ridicule, favorable and unfavorable criticism, as the announcement of the successful, practical application for the renewal of youth, and the prolongation of life.

On the one hand, there has been extravagant praise; on the other, ruthless condemnation. Ardent proponents of Steinach have predicted wonders and miracles, which the great scientist would be the last to claim. Hostile critics have misconstrued, misapplied and misrepresented Steinach's every work.

But out of the two extremes a fairly widespread realization of the true purpose and significance of Steinach's operation is gradually taking place.

The motive that prompted me to undertake this translation of Dr. Ishlondsky's masterly treatise, the most scholarly as well as the most readable exposition of Steinach's achievements, was my belief that a wider, popular knowledge of Steinach's experiments would inevitably lead to a strengthening of public confidence in Steinach's operation.

Dr. Ishlondsky, although comparatively unknown in the United States, has gained an enviable reputation in Europe through his numerous and valuable contributions in the field of biological science. His profound insight into the theories and experimental work of Steinach has been achieved through the opportunities for observation afforded by his connection with many of the research laboratories of Germany and Russia. His book, therefore, is author-

itative and certain to prove interesting to the American readers.

My viewpoint in approaching this translation has been a double one. First and foremost, it is my ardent desire to see Steinach's operation assume its proper place in the estimation of the general public.

The great difficulty, which thus far has prevented popular acceptance of this operation has been the unwillingness of the suitable subjects to undergo the treatment, which Steinach has outlined. This difficulty can be overcome by a clear understanding of the methods employed, and the advantages, which definitely may be expected. I believe that Dr. Ishlondsky covers the ground admirably, and I am convinced that a general knowledge of his book would help greatly to overcome the natural distrust to the new, untried, and unusual.

Secondly, I have approached the subject from the surgical point of view. While at present Steinach's operation is employed for the chosen few, I firmly believe that in years to come it will be as popular a surgical procedure, as the operation for appendicitis is today.

Despite the comparatively short space of time, since the introduction of Steinach's discovery into the United States, the results so far attained have been most encouraging. The results of my own experience with a limited number of cases is highly gratifying.

The future alone will prove the real significance of Steinach's operation.

HENRY S. PENN, M. D.

PREFACE TO THE AMERICAN EDITION

The reception given to this work by European society and medical circles proved to the author, that the subjects touched upon are finding general recognition. With great satisfaction does the author note the appearance of the American Edition because the United States offers the best ground for the practical solutions of these problems.

The center of gravity of scientific research is being gradually transferred to the United States. During the last few years America presented an enormous and highly interesting material, very valuable both in its method of execution as well as in the scale of its established observations.

The present American Edition differs from the original by a considerable change in the text and by the addition of a number of very important illustrations.

I consider it highly important to preserve in this work, the original plan of constructing and expressing the ideas, as a more certain means for the establishment of this particular synthesis between science and society which is so imperative for both.

I am greatly indebted to the Prussian Government Institute of Sexual Biology for a series of original photographs included in the new edition.

Thus, through Drs. P. Schmidt, C. H. Rowe, I was enabled to take into account a series of unpublished cases of Steinach's operation.

I also wish to express my acknowledgment to Dr. H. S. Penn for the English translation of this book.

Let this work give a new impetus towards scientific problems for the realization of which, the Great Republic is offering such a splendid foundation.

N. E. Ishlondsky.

CHAPTER I

THE HISTORY AND DEVELOPMENT OF THE PROBLEM OF REJUVENATION AND THE PROLONGATION OF HUMAN LIFE.

If we are wishing for an ideal, capable of uniting all the people a certain kind of religion of the future, it must be based on scientific grounds.

I. Metchnikoff.

Among the questions, which have long agitated the human mind, one has always retained a peculiar position, both because of the deep interest it has aroused in the investigator, and because of the difficulty of its solution. This question relates to the problem of Life and Death.

From the very dawn of mankind the event of death has left indelible traces on the young human mind. Primitive man could not look with indifference at the horrible and mysterious occurrence, which he faced at the death of a friend. The man who at one moment, was moving, talking, rejoicing, or grieving, was suddenly motionless, speechless and incapable of emotion.

This sudden change occurring in a human being at death must have involuntarily evoked in the primitive mind an apprehension, that there lives in the human body a Something that controls its speech, movements, and actions, and at the moment of death departs imperceptibly to those around, leaving a motionless corpse. Thus, the belief in the existence of a soul takes its origin. Herein lie all the theories of the duality of human nature. Here is the source of all fancies of a hereafter.

Immeasurably deep must have been the impression of death made on the young mind of the primitive man. Among the many other horrible visions, with which cruel nature so often astonished his imagination--amidst the phenomena of thunder, lighting and hailstorms--this phe-

nomenon of death, because of its mysterious surroundings and because of its still more destructive results, must have occupied a prominent position. The only sensation that all these horrible manifestations must have generated in the primitive man, is the sensation of infinite horror, and the consciousness of his extreme helplessness before the omnipotence of nature. Consequently, the idea followed that he must submit to nature, and must bow before its omnipotence in order to appease its frequent manifestations of anger. Here is the source of all religions.

However, the human mind, had also possessed the power of development, and so in accompaniment to his development, man began to note a certain regularity in natural manifestations, a certain system in their origin and course. Awakening critical reason began to suggest, that this system in all its phenomenal activities, apparently depends on certain constantly acting, permanent causes. His awakening spiritual ego began to agitate his mind and to stimulate efforts to seize those permanent causes, to gain possession over the constant powers, subjugate them, and learn to rule these natural manifestations. Here is the source of all the existing sciences.

In this manner originated physiology, the science of life, undoubtedly the most ancient of the branches of human knowledge. And one of the first problems that presented itself for solution to the nascent physiological science, was the question about the nature and causes of death and the means of combating and possibly conquering it. So, throughout the entire history of scientific human thought, appear numerous scientists, the most brilliant personification of human genius, who quite frequently, set as their only goal of all scientific investigations, as the ideal of their entire life, the solution of the old riddle of death: its manner, its natural causes, and the means of fighting it.

But in vain were all the efforts! Unsuccessful were all the quests of the alchemists for the philosophical stone, which was to cure all human ailments, or the elixir of youth, that was to prolong human life. Impractical

remained the dreams of the latter scientists, who sought, in one form or another, to find the solution to the old problem. Death implacably continued its destructive work, merciless even to the very alchemists searching for philosophical stones and to those latter scientists seeking to find in a special diet, the key to the solution of the problem.

But not in science alone did the question of life and death occupy a position of immense importance. Very early the problem penetrated into philosophy serving as a basis, on which were built almost all philosophical teachings and creating a ground, on which was built an enormous structure of pessimistic views.

From philosophy the problem of death penetrated into the literature and we may state definitely, that there is hardly a work of any considerable importance, which omits discussion of this question. All the works of Leo H. Tolstoy, in one form or another, touch upon this subject. Tolstoy himself was struggling all his life for a solution, and was nonplussed by the apparent impossibility of reaching it. In his novel, Anna Karenina, Tolstoy says through the mouth of one of his heroes: "But die one must, if not today--tomorrow; if not tomorrow, and even in 30 years around, is it not just the same?" This "just the same", this consciousness of an inevitable end, whenever it should come, has been from time immemorial, the stone on which have been breaking the highest human hopes, and under the pressure of which, the strongest people were rendered helpless.

On this literature, were brought up entire generations of human society, and in this manner, the pessimistic views, having built for themselves a formidable nest in scientific and philosophical thought, began to penetrate into the wider circles of society, and here to show their destructive influence on the human spirit.

It may be seen clearly to what profound social and political misfortunes such a spiritual state, generated by these pessimistic views, must have lead. Poisoning the intellect, killing the initiative, depressing the en-

ergy, this pessimism, instead of leading humanity forward, plunged it into a condition of sickly apathy. These views led to a mental stagnation and moral retrogression, creating a favorable ground for the development of the lowest human instincts. Many scientists correctly estimated the entire consequence of this development and were seeking some means for the struggle with pessimism. But certain fundamentals were necessary for a successful fight. It was necessary to destroy the roots of the pessimistic view, which had fortified itself in society. It was important to shake it to the very foundation and put forward and establish another understanding of life more satisfactory to the searching human mind. This great problem was destined to be solved by Elias Metchnikoff.

Metchnikoff was arguing, that the fear of death on which, consciously or subconsciously, is resting the entire structure of our contemporary pessimism, is nothing else but the expression of one of the many human instincts, namely: the instinct of life. Like all other general properties of the living oganism, both physical and spiritual, this instinct also in the course of the individual life, is undergoing a cycle of development. It begins its manifestations with the first signs of life, reaching its zenith with maturity, remaining in this stage until advanced age, and only then, gradually fading until complete disappearance. In younger years, this instinct of life, or in other words, this fear of death--is developed very little. This is why young men are so eagerly ready to meet any physical danger, showing examples of extreme bravery and daring. This explains the comparatively great number of suicides among the young. But gradually the instinct of life strengthens itself, and in maturity reaches full development. Then, one begins to value life a great deal more—the life instinct manifests itself more, so to speak, in the fear of death. One does not so readily undertake to perform acts or deeds, that are connected with any physical danger. In this state, the instinct of life remains till advanced old

age. And when at the age of about 70 or 80, as a result of physical causes, chiefly as a result of a past illness and unhygienic surroundings during his earlier life, a man perishes, the instinct to live is then still in its full development. That is why death seems at this time, both so horrible and undesirable. In this, according to Metchnikoff, lies the whole tragedy of mankind. The body refuses to serve just at the particular time, when the craving for life is at its highest point. However, if man were not to die prematurely, that is at 70 or 80 years, and did reach the normal limit of his life, which Metchnikoff considers at about 150 to 160 years, then, at that time, the instinct of life, like many other properties of the organism, would succeed in undergoing a complete retrogressive change. The fear of the approach of death would disappear entirely. Death, then, would present itself as a natural and desirable transition from life to eternal rest, no less pleasant, and no more horrible, than the daily transition from wakefulness to sleep. Then the pessimistic views, that are resting on this fear of death would disappear.

Metchnikoff recollects the question of Tolstoy: "But die one must! Is it not just the same, when?" And without hesitation answers: "No, it is not just the same!" For to die at the moment when the instinct of life (and this means the fear of death) is at its height, or to die when this instinct of life has succeeded in going through the complete cycle of its development, and when death appears, not as a spectre of horror, but as a natural requirement of the organism--this is decidedly not "just the same." Tolstoy, one of the greatest philosophers, could not find an answer to the question. Not knowing the biological laws of development of the instinct of life, he did not suspect that in his answer to the question ("Is it not just the same?") his own fears sounded nothing less, than a powerful protest against the approaching end of life. "And, therefore", says Metchnikoff, "all our attention is to be concentrated to prevent premature old age, and make it possible for the instinct of life to go through the entire circle of its development;

in other words, some means must be found to prolong human life until its natural limit." In order to find such a guard against premature old age, it is necesssary, first, to establish its real causes. Only then, by removing the latter, shall we be able to prevent the undesirable consequences. Metchnikoff has been working in both directions. Later, we shall acquaint ourselves, both with his theoretical views, about the source of old age, and also with the measures he offers to fight it. We shall point out here, that even these measures have not solved the old riddle of mankind. It had not been solved by the alchemist of the middle ages, or the possessors of the elixir of life, and it could not be solved by the latest predecessors of Metchnikoff, who like himself, were looking for the solution of the problem in various hygienic prescriptions.

Those who had been struggling for a longer and happier life, long ago disappeared from the midst of the living, but human beings still remained just as helpless as before, in the struggle against the ancient evil.

Moreover, investigators were found, who, by way of numerous scientific arguments and mathematical demonstrations, were trying to prove that all the attempts to solve the problem of old age and death, are destined to doubtless failure; that the period of 70 or 80 years apportioned to man by the psalm-singers, appears to be his limit even by physiological laws, for by that time separate parts of the organism are inevitably outworn and his stored up energy is spent. These investigators advised the scientists not to feed on infeasable dreams, and not to waste their valuable time on attacking problems incapable of solution. They were calling on the scientist to work for the improvement of our short life, instead of trying to attain its prolongation.

Just at this stage of the problem, when the general conviction in the inevitability of the evil, was at its height, at a time of a conventional submission, both to the fact of death, as well as to the shortness of our life, there appeared in the press the first information that the

physiologist of Vienna, Professor Steinach, succeeded in solving the oldest and the greatest problem of mankind--the problem of Artificial Rejuvenation and the Prolongation of Human Life.

The old dream, which had its reflection in marvelous national fables is finding, it seems, its definite realization. The name of the physiologist of Vienna, with which the general public is probably little acquainted, but which is, nevertheless, very well known to the entire scientific world, is a guarantee of the truth of the statements made, notwithstanding the seeminly strange garment in which the truth is clothed. It is not surprising, that thousands of telegrams expressing a willingness to undergo the operation for artificial rejuvenation come as the result of this information. Indeed, all the facts mentioned by Steinach, were strictly verified. The wonderful results of his artificial rejuvenation of old men and women, are it seems, beyond any doubt.

Moreover, to those who have been following for the last few years the development of teaching regarding the so called internal secretion, the discoveries of Steinach are neither unexpected nor sensational. The problem of Artificial Rejuvenation, which Steinach claims to have solved, appears to be a logical sequence to all the previous works, which this scientist has been carrying on with tireless energy and invariable success for the last twenty years. Immediately before the latest of Steinach's discoveries appeared another problem, so wonderfully solved by him a few years ago; the voluntary changing of sex in animals, the problem of artificial transformation of males into females and vise versa.

How did Steinach attain it? What led him to these wonderful discoveries? What is the nature of these wonderful transformations performed by the famous physiologist of Vienna?

CHAPTER II

THE GLANDS OF INTERNAL SECRETION

The works of Steinach, as has been superficially mentioned before, belong to the younger biological science, to the teaching about the so-called glands of internal secretion.

The founder of this teaching was a French physiologist--Brown Sequard, who, by way of numerous experiments, and clinical findings, came to the conclusion, that many organs, and especially the glands of our body possess an internal secretion, that they contribute to the blood particular substances, known as hormones, necessary for the performances of all the living functions of the body.

The removal of the organ producing the given hormones, or its destruction by disease is always followed by series of severe disturbances, which may ultimately prove fatal to the organism. This condition, established by Brown Sequard, was later confirmed by numerous experiments made on all organs of our body. The above may be formulated as a rule without exception. And so, Brown Sequard hit upon an idea: Is it not possible from the outside to supply the blood with these particular substances, of which it was deprived, as a result of the cessation or disturbance of function of the organ of internal secretion and, by so doing, to remove the abnormal changes in the body? Through a series of brilliant experiments, Brown Sequard proved the correctness of his supposition. It is important to note, that the nature of these substances, so powerful in their action, are entirely unknown to us.*

*I do not fully agree with the author on this point. The chemical composition of most of the hormones are pretty well known. Some are even synthetically prepared. Translator

However, we soon learned to use the substances just as we have been using electricity, when we had no conception about electrical manifestations.

The teaching of Brown Sequard about the internal secretion, which began its development at the end of the 19th century, has grown very rapidly into a magnificent branch of science. After numerous striking investigations and unusually interesting discoveries, which soon found their application in medicine, this new teaching soon became the foundation of a special method of treatment--the so-called organotherapy, and the study of the hormones soon centered on itself the attention of all biologists.

Indeed, it is impossible to give here, a complete review of all the phases in the study of internal secretion. We shall, therefore, confine ourselves to the most important facts.

An interesting example of an organ of internal secretion is presented by the pancreas. The external secretion of this gland contributes to the intestine a very important digestive fluid, which has been known for a long time. However, in 1889, it was discovered that the pancreas possesses also an internal secretion, giving off hormones necessary for the correct utilization of starchy substances consumed by the organism. Should the pancreas become diseased, or in case they are removed by a surgical operation, its internal secretion ceases, and with it the supply of hormones it produces. As a result, the sugars are not utilized and are accumulated in the blood. From the blood the excess is excreted by the kidneys. This results in a condition known as diabetes. However, if the entire pancreas is not removed from the animal, and if only a small piece is left--whether in its natural place or transplanted into any other part of the body, diabetes will be prevented. But with the removal of that small particle, the sugar in the urine will reappear. Hence, it is quite natural to conclude that the pancreas is contributing to the blood a hormone, which is important for the proper utilization of the sugar in the organ-

ism. The removal of this hormone from the blood leads to diabetes. By a reintroduction of this element into the blood stream the disease is prevented.*

More curious appears to be the function of the thyroid. This is a small gland situated just below Adam's Apple on either side of the throat.

A form of idiotcy known as cretinism and a peculiar disease, called myxedema, are both connected with a deficiency of the hormone in the blood produced by this gland. The same diseases are caused by total removal of the gland surgically. On the other hand, a very severe condition, known as Basedow's disease, will result with increase of secretions, i. e., with the greater amount of hormones in the blood.

As early as 1856, Shiff first pointed out, that when a dog has its thyroid gland removed, the animal soon dies. Later, surgeons have noticed that after the removal of the thyroid gland in a goitre operation, the patient suffers from severe digestive disturbances and a subnormal activity of the nervous system. Finally, Kocher could definitely prove that the causes of myxedema and cretinism are closely related. If the operation for the removal of the thyroid should be performed at a comparatively youthful age, then the above mentioned disturbances would be more pronounced.

These disturbances express themselves on one hand by retarded growth, and underdevelopment of the body, and on the other hand by a series of psychic symptoms, which would indicate an arrested mental development, such as, poor psychic perception, extreme slowness of all mental processes, poor memory, marked apathy, indifference to surroundings and absence of emotional stimulation. In a noted case of the surgeon Brunce, an operation for the removal of the thyroid gland was performed on a 10 year old boy. Investigation eighteen years later showed this patient to be about the height he was at the time

*The recent discovery of Insulin, a pancreatic extract, now employed successfully in the treatment of diabetes, confirms this view. Translator,

of operation. Besides, there were disclosed a definite lowering of the intellect, a total moral indifference, and a complete incapability for any work.

However, a still more striking picture of marked physical and psychic disturbances are presented by the congenital cretins, living in the narrow, sunless valley of Switzerland and other mountainous countries. (Illustration 2).

As a result of a very severe diseased process, which takes place either in their infancy, or in very early childhood, the function of their thyroid gland, despite apparent enlargement (goitre) is, nevertheless, markedly low. Such an individual at the age of 30 or 40, will be no more developed, either physically or mentally, than a youngster of 8 or 10. On the other hand, Basedow's disease, which is a result of an increased function of the thyroid is characterised by reversed symptoms. While the cretins astonish us with their mental dullness and indifference, the individuals with an increased thyroid function are capable, good mathematicians, nervous, restless and irritable.

Thus, the hormones of the thyroid gland not only regulate the function of nutrition and are not only extremely important for a normal activity of all the processes of the organism, but are of absolute importance for all the highest mental functions. The noted physiologist Gley, to whom we are greatly indebted for our knowledge about the function of the thyroid gland, among other things says: "The origin and activities of the highest human faculties depend, apparently, on purely chemical reactions, which are the products of a definite secretion. Let the psychologist consider these facts."

Such is the significance of the hormones of the thyroid gland. However, the following is particularly interesting. It was pointed out that a complete removal of the thyroid results in a serious illness, which is followed by the death of the animal. Yet, if the animal is given a thyroid extract, just at the time when unmistakable symptoms of death make their appearance, then, within

a few minutes, the threatening signs begin to abate. The strength of the convulsions lessens and later the convulsions disappear entirely. The respiration acquires a regular rate, the animal begins to walk and quickly returns to its normal condition. If instead of the whole gland, only a part is removed, the remaining portion continues to produce the hormones necessary for the organism. At present, surgeons perform this operation for the partial removal of the thyroid in case of increased function of the gland.

The beneficial actions of various thyroid preparations, containing the hormones, are employed not only in cases of surgical removal of the gland, but also in all forms of myxedema and cretinism (dwarfism). The same beneficial action is further shown in cases of congenital myxedema and cretinism, which are a result of a natural underdevelopment of the gland. The afflicted individual is quite frequently improved beyond recognition, both physically and mentally. The general functioning power is increased, mental alertness revived and the functions of the brain regenerated. All these changes appear very soon, and frequently after a few weeks of treatment. The child-cretin, almost motionless before treatment, becomes lively and active. His walk is more confident, his face is brighter, and in time, he shows an intellegent expression, gradually acquiring a normal appearance. (Fig. 3 and 4)

All these facts prove beyond any doubt, that the thyroid gland produces hormones, which are absolutely important for the proper maintenance of all the living processes of the organism.

With the thyroid are closely connected, both anatomically and functionally, the parathyroid glands, (Fig. 1) which are more profoundly interesting in their action. These are four minute bodies, each the size of a pin head, and weigh only a few grains. Nevertheless, notwithstanding their size, these glands play an important role in the life of the organism. Their internal secretion produces hormones, which have a strong influence

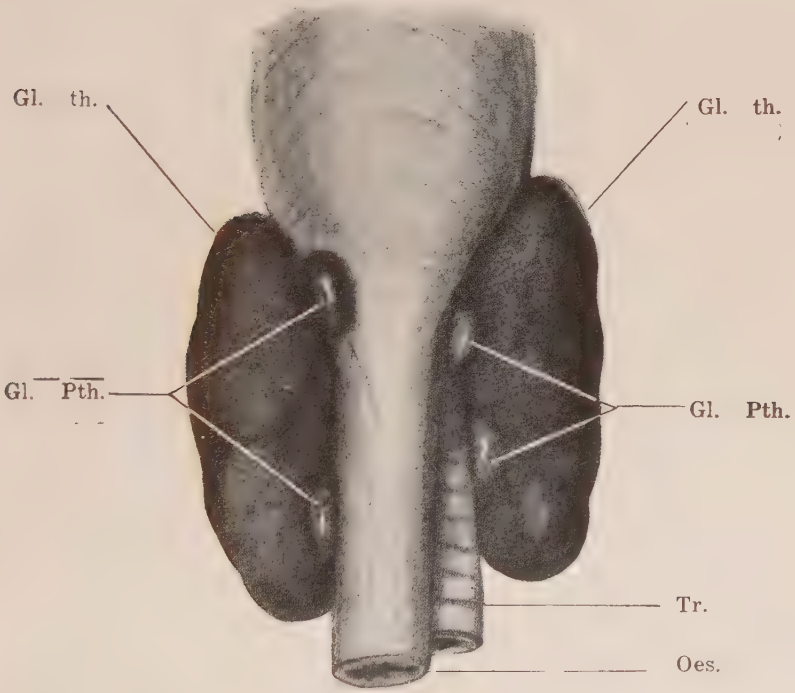


Illustration No. 1.

The relation of the thyroid and parathyroid glands.

Gl. th. — Thyroid gland. Gl. Pth. — Parathyroid gland.

Tr. — Trachea. Oes. — Oesophagus.

Illustration No. 2.

Adult Cretins

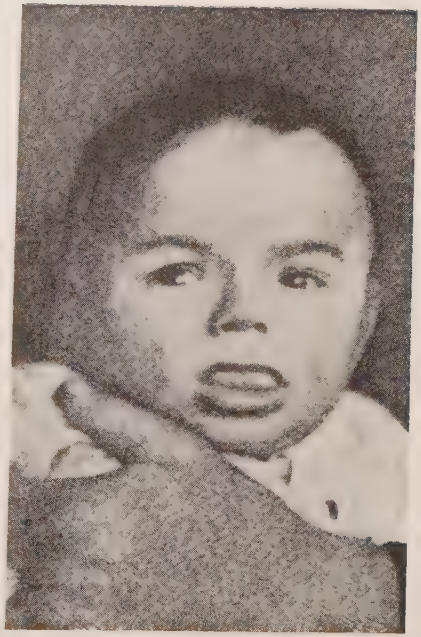
A

Girl cretin before treatment with thyroid glands. Obvious signs of cretinism.

Illustration No. 3.

B

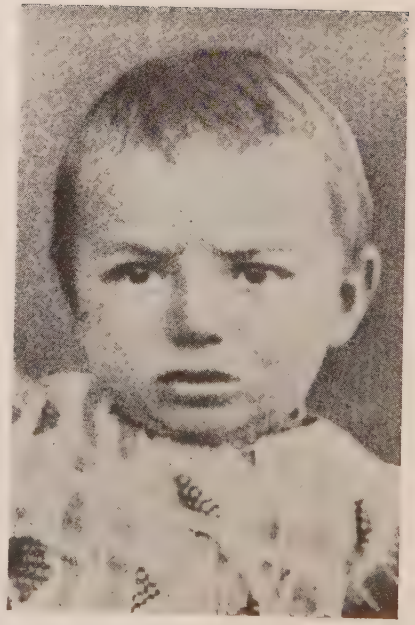
Girl cretin after treatment with thyroid glands. A normal lively appearance.



A

Boy cretin before treatment
with thyroid gland.

Illustration No. 4.



B

Boy cretin after treatment
with thyroid gland.

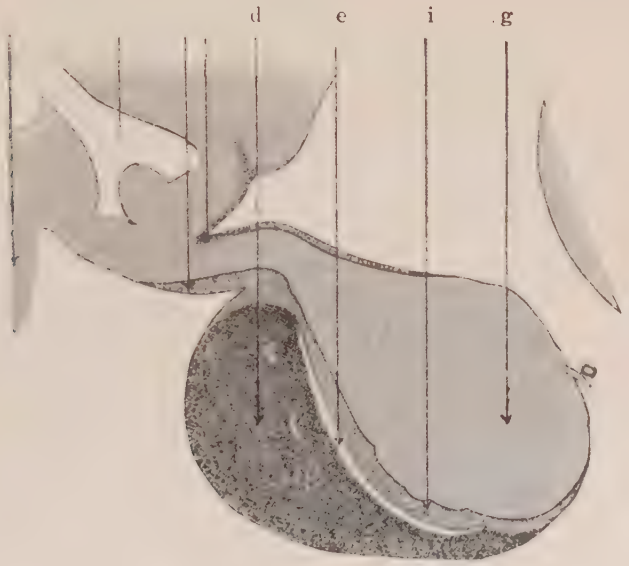


Illustration No. 5.

Pituitary gland of an adult male in longitudinal section.
(d) Anteriur part of the gland. (e) The hypophyseal.
(i) The intermediate part. (g) Posterior part of the gland.

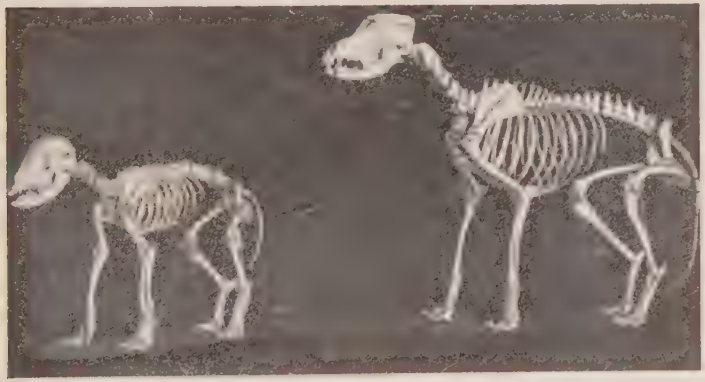


Illustration No. 7.

The influence of the operation for the removal of the pituitary gland on the growth of the skeleton. These dogs are of the same breed, both at the age of fourteen months. In the dog on the left the pituitary gland was removed at the age of two months. (After Aschner)

Illustration No. 6.

Comparative skeleton of akromegaly with the normal. In the former there is seen a considerable increase in size of the lower jaw, a marked deformity of the head, chest and spine, and a marked overgrowth of the extremities.

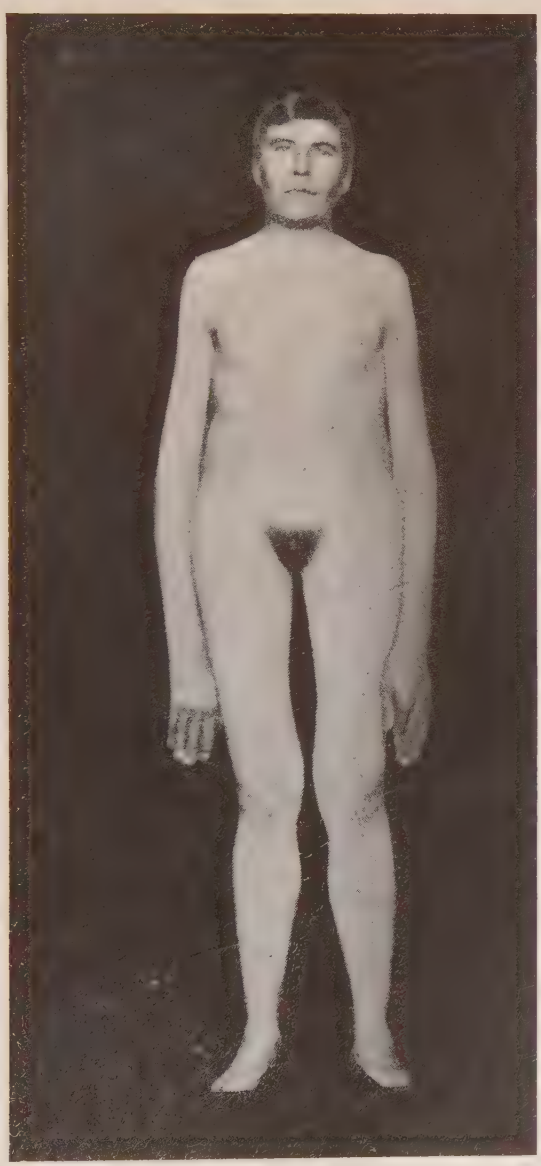


Illustration No. 8.

A twenty-one year old eunuch. (After Tandler and Gross).

Illustration No. 9.

A twenty-four year old eunuchoid.
Note the rich deposit of fat.

over the action of the entire nervous system. When these glands are removed, death follows a few days after operation.

Within the last few years great interest was attracted by the pituitary gland. This is a small body, the size of a pea, attached to the base of the brain. (Fig. 5) An excessive action of this gland at an early age is accompanied by an excessive development of the skeleton, leading to a gigantic growth. An increase at maturity in the function of the pituitary (i. e. the entrance of a greater amount of its hormones into the blood) produces a pronounced growth of the extremities and the bones of the face. This condition is known as akromegaly. The same skeletal changes are also observed in pituitary enlargement, in which case, there is also an enormous increase in amount of the hormones. An individual subject to this disease, even in cases where the process of growth had long ceased, within about two years begins to show marked enlargement of the feet, the wrists, and the bones of the face, especially the upper and lower jaws. The growth also affects the extremities of the skeleton in general, but the result is an extreme deformity on account of the disproportion between the overgrown parts and parts that have retained their previous size. (Illustration 6). In these cases, the X-ray usually shows an enlargement of the pituitary gland. The removal of this enlargement affects a cure.

The complete removal of the pituitary gland frequently results in the death of the animal in about 2 or 3 days after the operation. In cases not followed by death, there soon appear marked disorders, differentiating the operated animals from the non-operated ones. While the latter are growing normally the growth of the former is suddenly arrested. The difference may be noticed even within a month, and after 3 to 6 months it becomes so marked, that dogs, for instance, born at the same time can hardly be recognized as belonging to the same breed. (Illustration 7).

The disorders of growth express themselves especial-

ly in noted peculiarities of skeletal structure. The bone formation in the various parts is slower, incomplete and weak. As a result, the long bones are crooked and easily broken, so that the operated animals not only prove to be dwarf-like in comparison with the normal, but also show clearly a marked monstrosity. Further there is observed an increase of fat on the operated animal, and at the period of maturity it is found that their sexual organs and secondary sexual characteristics *have not developed. Besides these external peculiarities, there is also a marked change in all the most important internal organs.

Thus, any injury to the hardly noticeable gland of the brain, provokes the deepest disturbances in all the functions of the organism. Retarded growth, disturbances of digestion, destruction of sexual life--these are the consequences that follow the removal of this little body, whose significance to the organism until recently remained entirely unkown. All these disturbances, however, soon disappear by the introduction into the blood of the animal an extract of this gland, i. e., its specific hormones.

The above mentioned observations explain the nature of some of these diseased conditions, whose origin no one could previously suspect. And what is particularly interesting, they throw a light on such obscure problems in biology, as the formation of dwarfs and giants. Moreover, these observations open before us the way for a practical solution to these problems. Perhaps, the time is not far off when, by employing the various preparations containing the hormones of the glands of internal secretion, we shall be able to control, voluntarily, the process of growth and development, transform dwarfs into giants, and cretins into capable mathematicians.

*Secondary sexual characteristics are called all those features differentiating one sex from another, except the sexual organs. (Primary sexual characteristics).

CHAPTER III

THE SEXUAL GLANDS AND THEIR ROLE IN THE LIFE OF THE ORGANISM

The most interesting of all the previously mentioned organs of internal secretion are undoubtedly the glands of reproduction. With this subject Steinach's works are closely related, and these glands are the source of all those marvelous changes, which have been carried out by this great physiologist. The glands are also interesting in this respect, that with their study, the foundation for the present knowledge about the glands of internal secretion was laid. With these particular glands, Brown-Sequard carried out his famous experiments, when in 1889, at the age of seventy-two, he injected into himself an extract of interstitial glands of a rabbit. Feeling a complete decrepitude of advanced old age, being easily fatigued and noticing a progressive loss of his scientific activity, which is natural at this age, Brown-Sequard explained this condition with his long beloved theory. According to this, all the glands are not only organs producing this or the other secretion, carried off by their canals ("external secretion") but they also contribute particular substances directly to the blood, (internal secretion). At old age the function of the sexual glands are weakening or disappearing entirely and the semen is not secreted. Thus, the external secretion of the gland is lost. However, at the same time, and probably considerably earlier, the internal secretion also is greatly diminished. According to Brown-Sequard, the latter is the most important, for the organism maintains its strength only as long as the stimulating substances--(the hormones), the product of internal secretion of the reproductive glands, are circulating in the

blood vessels. So great was Brown-Sequard's faith in the correctness of his opinion, that he decided to try out his supposition on himself. After preparing a sterile extract from a rabbit's glands, he injected it into himself. The action of the extract on Brown-Sequard was amazing. His working capacity returned, he felt himself greatly rejuvenated and again was able, though only for a short time, to work in the laboratory. These experiments found numerous imitators, because every great faith in anything affects also others, and because in many intances the "Brown-Sequard injection" has really produced, although for a short duration, a wonderful beneficial action. This circumstance, as well as the personality of the promoter of the new idea and his deep faith in the truthfulness of his teaching, has produced a deep influence on the scientific world. After twenty years of co-operative scientific research in various countries, there was created an extensive new branch of physiology, the branch of the glands of internal secretion. Undoubtedly the conception of Brown-Sequard about the function of internal secretion of the sexual glands could not have remained at a standstill. Inevitably, these conceptions with the development of scientific knowledge were to undergo an evolution, develop and shape themselves at last into those forms, which at the present moment appear firmly established. Now we know about the function of the sexual glands and their internal secretion incomparably more, and have about them a more correct and specific conception, than the French physiologist could have had at that time. These data we shall now consider.

Anyone living on farms knows what influence castration, or the removal of the sexual glands has on our domesticated animals. Their character is sharply changed. For instance: such violently unruly animals as bulls or colts when castrated become quite phlegmatic, very workable, submissive oxen and mares. Besides, it is observed that the castrated animals have a greater tendency to accumulate fat, than the non-castrated. The own-

ers take advantage of these phenomena.

Further observations show, that all those so called secondary sexual indications, like the comb, and the characteristic voice of the rooster, the horns of a deer, the splendid tail of a peacock, the mane of a lion, etc., develop at maturity only in the presence of a healthy activity of the sexual glands. Should the sexual glands happen to be removed before maturity, before the secondary sexual signs had a chance to develop, these secondary signs will not appear at all. In spite of the fact that humanity has been using the above mentioned properties of sterility from time immemorial, science has just recently brought to light the real cause of the changes that take place in the organism under the influence of castration.

Similar observations were also made on human beings. Here the changes produced in the various parts of the organism by castration could be observed in its clear form, not complicated by any other diseased conditions, thanks to the fact that some religious sects of eunuchs, who consider the physiological function of reproduction a sinful activity, practice artificial removal of the sexual glands, frequently in the very early childhood. In view of the ease of this operation on men, the males are particularly subject to it. Consequently, the majority of observations were made on the Eunuchs. Under the influence of the operation, as observations have shown, there appears in various parts of the organism, a marked change. At first we notice the disappearance of all the secondary sexual characteristics. In the male these are expressed by the growth of hair on the face, by a pronounced Adam's apple on the throat, a considerably better development of the skeletal and muscular system, a roughness of voice and also all the peculiarities of the masculine behavior, his natural inclinations and his typical mental attitude. If the removal of the sexual glands is performed at an early childhood, all those manifestations do not appear. If, however, the operation is performed at maturity, when all the enumerated indications succeeded to

develop to their full capacity, then there is a gradual weakening and even a complete disappearance: the growth of beard and mustache ceases and the hair already grown, falls out little by little. The voice changes in a very sharp manner and becomes more shrill, like that of a woman. This is the result of the transformation of the form and size of the larynx. At the same time there is noticed an unusual increase of fat and also a disturbance of the normal proportions in the development of the skeleton. Particularly typical in these instances is the considerable increase of the extremities both upper and lower. (Illustration 8). As a result of these changes to which are also added changes of the mental attitude in the form of extreme sluggishness of all the psychical functions, these people acquire a peculiar appearance, from which, in the majority of instances, one can guess the existing deficiency. On one hand an entire group of physical signs distinguishes them from the normal people, like the yellow color of the skin, falling out of the beard, high pitched voice, general debility, etc. On the other hand the psychical peculiarities stamp them in a very characteristic manner. The initiative and energy, which are natural with every normal male, are lost entirely and although they become quite industrious and hard working (similar to the oxen), the circle of their activity is very narrow and limited. At the same time, they also become miserly, man-hating and at the end extreme egoists, for whom the torturing of their friends become a source of pleasure.

Similar changes in the physical as well as the psychical spheres, are also observed in the frequently met eunuchs of the East. And also in persons suffering from natural underdevelopment of the sexual gland (eunochoid). (Illustration 9).

The most interesting feature among the many consequences of castration is the characteristic influence it has on the voice of one operated on. This particular feature had been serving, for a long time, as reason for castration, with the ultimate aim of utilizing it. The wonder-

ful ability of the Italian castrated singers had been famous all over the world for the entire period of the middle ages. As early as the 18th century 2000 children were castrated every year for this purpose. "La voix des castrate imite celle des cherubn au ciel"--"The voice of the castrated is like the voice of the angels in heaven," was a very popular saying at that time. And in the windows of almost every nurse or barber of Rome one could read: "qui si castrano ragazzi a buon mercato"--"here boys are castrated cheaply." In the famous St. Peters' Church even now can be found castrated singers.

However, at the present time castration is rather a rarity and is now employed exclusively as means of prevention or treatment of disease.

For the purpose of treatment castration is chiefly undertaken in various diseases of the sexual glands, especially in cases of cancer, tuberculosis, and also in cyst formation of the testicle.

As a preventive measure this operation is employed in these cases, when in view of some very important reason it is necessary to deprive a given person of his reproductive ability. Thus, it is used in the criminals and mentally deficient for the purpose of sterilization. In this country there exist special laws regarding this matter.

A very curious incident clearly illustrating the changes as a result of castration is represented in accompanying photographs (Illustrations 10, 11, 12).

There is shown a castrated singer B, who from the biological point of view is highly instructive.

B. was born in 1883. When he was twenty-one, he became the victim of an attack, in which he received a severe cut with a knife injuring both testicles. The surgeon was compelled to remove entirely the hopelessly damaged glands. After ten years i. e. in 1914, B was examined by Dr. Magnus Herschfield, and the following results were shown.

In the region of the sexual organs there are three scars, two from wounds of the attack, the third, the result of an operation. The skin on the entire body is very

thin and delicate. The musculature is poorly developed, soft and sluggish. On the other hand, after the castration there developed a rich layer of fat, as a result of which the forms of the body became rounded. The growth on the face entirely disappeared and in the region of the arm pits it is also absent. There is a strong development of the breasts, which have an entirely feminine appearance, pronounced and tense. The circumference around the waist is 77cm. The blonde hair on the head is long, thick and soft. The growth on the face in the form of mustache and beard, which up to the castration were already strongly developed, gradually disappeared after the operation. His larynx is small, the adam's apple is almost entirely unnoticeable. In full accordance with the size and shape of the larynx there is a typically beautiful feminine voice, which is gradually increasing in volume. At the present time the patient is singing soprano up to B.

With his graceful motions, inclinations, and habits, B produced a very feminine impression. He is very fond of fancy dresses, ornaments and perfumes. His chief interests are the theatre, fashion, flowers and music.

An interesting phenomenon is the periodic changes. Quite regularly there appears a time when B is unwell, when he is ill. He feels at a time tired, broken up and suffering from dizziness, headaches, irritability and mental depression.

B. is very inconstant in his moods, bashful, timid and shows an inclination to everything that is supernatural.

The sexual feeling of B after the castration disappeared entirely. But instead there appeared typical motherly feelings. He has a great liking for children and would consider himself fortunate if he could bring one to the world.

This is the picture of all those deep alterations, both physical and spiritual in the life of B, which followed the removal of both sexual glands.

Now we know the reason for the influence of castration on the organism of animals and human beings. As

was made clear by an entire series of more delicate investigations, every sexual gland in reality consists of two inculcated parts: a reproductive and an interstitial gland, called by Steinach the "gland of maturity". In the male, the former consists of seminal canals and produces the spermatozoa, serving for the fertilization of the ovary. The latter part of the gland is situated in between the seminal canals in the form of collected cells of special character. These were first discovered by Leydig in 1859, and are named after him. The glands are comparatively independent of one another and each plays an entirely different role in the organism.

To the interstitial glands alone (Illustration 13) belongs the internal secretion, i. e. they alone are producing and contributing to the blood the sexual hormones, which as we have shown, have profound influence on the development of the secondary features, as well as on the physical and psychical world of the human being in general. As far as the seminal glands are concerned, their role is limited only to the external secretion i. e. to the contribution of spermatozoa. Similar relations, as we shall show later, are also found in the female sexual glands, i. e., in the ovary.

The discovery of the interstitial glands have not, however, diminished in any way the merit of Brown Sequard. Through his brilliant experiments he has proved the existance of the internosecretory function of the reproductive glands, and by so doing, laid the foundation for the teaching of internal secretion in general.

It is interesting to note, that a long time before Brown-Sequard, the idear of the internal secretion of the sexual glands was expresed by Kabanis, a famous physician, philosopher and poet, of the 18th century, who has pointed out the important role, which the sexual glands play in the history of the development of the individual distinction between the boy and the girl. In his famous "Du physique et du moral de l'homme" he expesses the cause of these differences in the following manner.

"The masculine sexual glands are producing a partic-

ular fluid, which, upon entering into the blood stream, contributes to it a more exciting and active property. This is expressed by the fact, that in the epoch of formation of this fluid, the voice of the youth becomes stronger, his motions harsher, and his facial expression bolder and more definite. At the same time his face and certain parts of his body are covered with hair--the sign of the appearance of his sexual strength."

"On the other hand, he continues, everything confirms the opinion that the ovaries of the female are producing a particular fluid, whose entrance into the blood results in new and active emotions. The appearance of menstruation, increase in size of the breasts, and other sympathetic indications, which are absent before, clearly show, that the ovaries have begun to function. Simultaneously, the lovelier lustre in the eyes, the greater expressiveness of the glance and the entire face with the appearance of a deeper discreetness and timidity, leave no doubt as to the exciting influence on the blood of the ovarian fluid, whose presence decides during the period of formation the individuals' destiny as a woman.

Kabanis also places all the other moral and psychical peculiarities in temperament of the boy and the girl in accord with the different secretions of the sexual glands.

We can see then, that the idea of the closest dependence on the internal secretion, of the reproductive glands, of all the so called, secondary sexual indications and characteristic sexual peculiarities, was expressed as early as the 18th century. But as has happened with the majority of great ideas, this thought expressed by Kabanis, passed over by his contemporaries, was destined to play an important role in biology. It also gave a leading thread for the solution of numerous social problems in connection with sex. Only very recently it was resurrected, but this time not to be smothered, giving impulse to a series of wonderful investigations, which found a particularly clear expression in the recently published experiments of Steinach.

We have already mentioned that the latest of Steinach's discoveries, concerning artificial rejuvenation, is decidedly not accidental or unexpected in the works of this investigator. These discoveries are the results of inevitable deductions from all his previous work, to which he gave more than twenty years of his life. All his works are devoted to one question--namely, the question of the internal secretion of sexual glands and their influence on the development of the organism. One after another, Steinach's works leave the laboratory, explaining this question in various forms. One after another, follow the experiments, astounding in their scientific beauty, each one of which is a further development and a continuation of those before it, and at the same time preparing the ground work for some other discovery. Only slowly in the chain of these works, was crystalized the last problem so bravely presented by Steinach--the problem of artificial rejuvenation, which centered on itself, the attention of the entire scientific world, as well as wide circles of society.

What road did Steinach choose for the solution of this great problem? How did he gradually unfold the plan of his work, which led to these discoveries?

CHAPTER IV

THE FIRST OF STEINACH'S EXPERIMENTS AND THE PROBLEM OF VOLUNTARY CHANGES OF SEX IN ANIMALS

Steinach, in his first works aimed to explain by experiments, as the only reliable means, the particular functions of the sexual glands, which the old authors (Kabanis, Brown-Sequard and others) had ascribed to them only theoretically, or at its best, only on the basis of daily observations. This problem Steinach attempted to solve by means of excising and transplanting sexual glands. And then he studied the changes in the organism, which followed the operation.

It is necessary to state that, such experiments of transplanting the male sexual glands had been performed a long time before in animals, which have not attained sexual maturity. The seminal glands were excised and as soon as possible placed in the abdominal muscles, or simply under the skin of the same animal from which they were removed. In numerous instances the transplanted glands grew to the surrounded tissues. They were soon joined by branches of the surrounding blood vessels, and as a result of this, the supply of blood and nourishing material had proven sufficient to such an extent, as to enable them to continue their growth and development. Of course, they lost every connection with their usual blood supply, were surrounded by connective tissue and their seminal production stopped, so that the operated animals were destined to an unavoidable sterility. This latter fact was equally inevitable, because the transplanted glands were entirely separated from their canals, and consequently the spermatozoa, even if they were produced by the gland, did not have the nec-

essary outlet. Yet, notwithstanding the sterility, the operated animals in their further development proved to be actual males. Without any difficulty they developed the secondary sexual characteristics and, therefore, did not in any way resemble the castrated animals. At the same time they developed quite normally the "mental attitude" of the male--the desire for the female. In cases, however, where the transplanting was not successful (i. e., when the glands failed to "take root", as happens quite often, and were destroyed in their new place), the products were--real castrates.

The result of the experiments can have only one explanation, namely, that there is going on in the sexual glands of the male, a process of internal secretion, that there are produced and enter into the blood particular substances, which evoke in the organism the development of all the secondary sexual characteristics.

On the basis of these facts regarding the activity of the male sexual glands, the supposition was expressed a long time ago, that the development of the secondary sexual features in the female is dependent entirely on the internal secretion of the female sexual glands, the ovaries.

This supposition was proven in the most wonderful manner, as, for instance, it was shown that castration in women, which is sometimes necessary in cases of diseased ovaries, produces a typical influence on the organism.

Here, there is also a weakening and gradually an entire disappearance of the secondary sexual characteristics. The voice becomes harsher, acquires a masculine semblance, the breasts diminish in size, the development of the muscular system is greatly increased, and in short, the woman, to a considerable degree, begins to resemble a man.

Experimenting on young rats, Steinach could not only confirm the established hypothesis, but even broaden them considerably.

After removing the testicles in the young males, Steinach produced a condition of the usual castrates. With

the transplanting of the glands in the animals, under the skin or into the abdominal muscles, Steinach prevented all the consequences of castration. Then later, removing the transplanted glands, Steinach again produced the disappearance of the secondary sexual signs, both physical and psychical.

Now, investigating the newly removed glands under the microscope Steinach could prove that the structure differs markedly from the normal ones, i. e., from the structure of the testicles before the transplanting. (Illustration 14). The reproductive part of the gland, the seminal canals, containing the spermatozoa, suffered a retrograde degeneration, but the tissue in between the canals strongly developed. This is the particular part of the gland, which was credited with the interno-secretory activity. So that, notwithstanding the almost complete destruction of the seminal part of the gland, the animals were normally developed as far as their sex was concerned. From the above, it was proven that the seminal part of the sexual gland, with the inclosed reproductive cells, does not play any dominating role in the sense of its influence on the secondary sexual characteristics of the animal. From these same experiments it undoubtedly follows, that the cause of this development of the organism sexually, must be recognized to lie in the preserved, and strongly developed interstitial gland, so that only with the cessation of its function (in cases when the gland fails to take root, or by the removal of the transplant) there appear all the consequences of castration.

Thus, the seminal and the interstitial glands appear to be entirely independent of each other, fulfilling entirely different functions in the organism. The preserved interstitial part in transplanted glands Steinach named the "gland of sexual maturity" (Glandula Pubertatis). This particular gland of "sexual maturity" plays the chief role in Steinach's experiments on artificial rejuvenation, which we shall consider later.

Similar relations, as we have already pointed out, were

also found in the female sexual glands, i. e., in the ovaries. Here it is possible to prove the existence of two independent substances. One is a reproductive portion, contributing to the ova, necessary for fertilization. This part, similar to the seminal canals in the sexual gland of the male, is destroyed after the ovary is transplanted. The other part,--the interstitial, possessing the internal secretion, i. e., producing the hormones, controlling the secondary sexual characteristics, this interno-secretory part of the ovary is not only not destroyed after the transplantation, but, similar to the interstitial gland in the male, is powerfully developed. This is called, according to Steinach's Terminology, the female "gland of maturity".

In these experiments Steinach made one very important observation. In one of the young males, after transplanting the testicles into the abdominal muscles, he noticed an unusual increase in sexual tendencies. These animals came into extreme sexual excitement, and took possession of the females not only during their rutting period when intercourse is naturally taking place, but even outside of that period, a thing that never happens with normal males. Such castrates with the transplanted sexual glands, had consequently surpassed, in the sense of their sexual development, even the normal males. Steinach, succeeded, as he expressed it himself, to produce a "hypermasculine" type from his castrates i. e., made of it more of a male, than nature itself.

Upon further investigations of the sexual glands of these animals under the microscope, Steinach could prove, that the interstitial part of the gland was particularly strongly developed.

Analogical results Steinach obtained in his experiments on the females. Here he also succeeded by a timely transplantation of the ovaries not only to prevent all the effects of castration, but frequently was able to obtain an unusually marked development of all the feminine secondary sexual characteristics. And also in some of these cases he succeeded to "hyperfeminize" his females, in

other words make them more feminine, than they usually appear in nature. Here also, he was able to establish by means of microscopic findings, a particularly powerful development of the feminine interstitial glands, similar to that of the testicles.

In this manner was experimentally proven for the first time the closest relation between the unusual instinct on one hand, and the particularly powerful development of the interstitial gland on the other. This almost mathematically-exact proportional relation, between the function of the "gland of maturity" and degree of development of the secondary sexual characteristics appears even a greater proof of the truthfulness of Steinach's deductions regarding the role of the interstitial glands.

After having established the independence of the "gland of maturity" in the organism, Steinach asked the following question: "Are the actions of the male and female "glands of maturity" the same or are they strictly distinct in the appurtenance to one or the other sex?" In other words, does the action of the internal secretion possess a sexual specificity?

The solution of this problem represents one of the most beautiful links in the enormous chain of Steinach's works. Before its scientific beauty and ingenuity, fade even the experiments with artificial rejuvenation.

If the actions of the secretion of the male, and female "gland of maturity", Steinach was reasoning, are exactly the same, then it should make no difference whether testicles or ovaries are transplanted into the castrated animals. In both cases the body, as well as the mental attitude of the animal should develop normally.

If, however, its action is strictly distinct for each sex i. e., if the secretion of the "glands of maturity" possesses a sexual specificity, then the transplantation of a testicle, or ovary into the castrated male, is distinctly not the same thing. Namely; in case of transplanting a testicle into the castrated male--there should develop masculine secondary sexual characteristics, and a corresponding men-

Illustration Nos. 10, 11, 12.

A man after the loss of his sexual glands at the age of twenty-one. These photographs represents him in his present profession as a singer in female roles. His physical, as well as his spiritual life became decidedly feminine after the loss of the glands. His sexual desires have entirely disappeared.

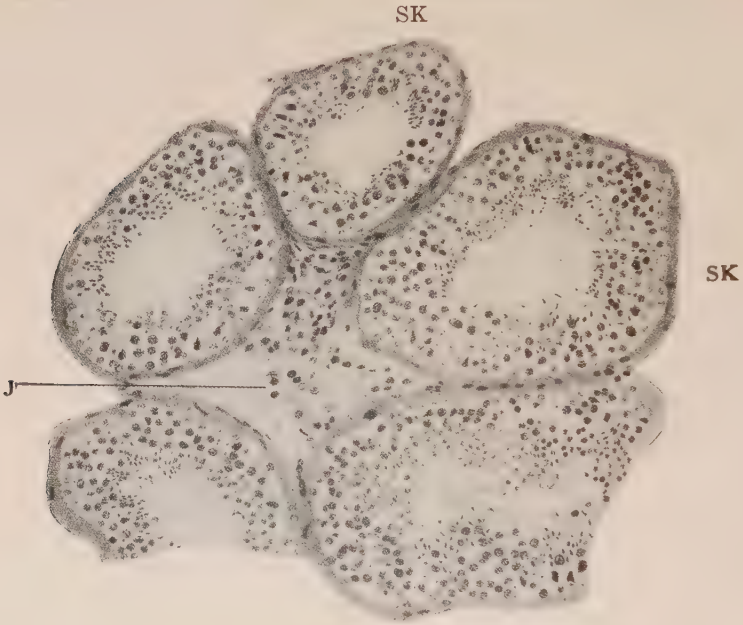


Illustration No. 13

Cross section of testicle of an adult (After Steinach) Magnified 150 times. SK--Seminal canals. J--Interstitial cells. (Leydig's cells).

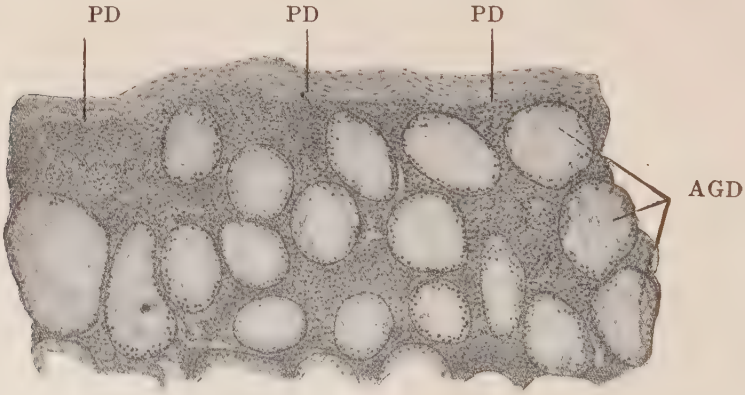


Illustration No. 14.

Cross section of transplanted testicle of guinea pig. (After Steinach). Note the retrograde degeneration of the seminal canals (AGD) and the powerfully developed interstitial tissue, or "Gland of Maturity". (PD).

tal attitude, that is, the affinity for the female. On the other hand, in case into this castrated male were transplanted not the testicles but the ovaries i. e., the female "gland of maturity", there should develop not masculine, but feminine secondary sexual characteristics, and a feminine "mental" attitude, the desire for the male. If this latter hypothesis should come true, Steinach thought, then it would be possible to change voluntarily the secondary sexual signs of an animal, depending on the kind of gland transplanted--masculine or feminine. It would then be possible, stated Steinach, by means of castration of the animals and subsequent transplantation of the corresponding (opposite sex) glands, to change a male into a female (feminization) or a female into a male (masculinization); and this supposition of Steinach was proven in a practical way.

Steinach was experimenting on rats and guinea pigs and in both cases the results were the same. At first it was disclosed that the ovaries transplanted into the male took root quite readily in the tissues of their new host, but only in those cases, where the male was previously castrated. Otherwise, the experiment was unsuccessful and the transplants perished in their new place. However, in cases where the transferred ovaries did grow, the organism of the male betrayed to a considerable degree, a normal female.

First, under the influence of the ovaries, there was observed in the operated animals a marked underdevelopment of the masculine sexual features. We know, that castration alone leads to the underdevelopment of the organs characteristic of the male. Under the influence of the transferred ovaries this underdevelopment reaches a considerably greater degree, and it spreads not only to the secondary, but also to the primary sexual characteristics. Thus, the external sexual organs, which usually develop feebly in the castrated animals, now under the influence of the transferred ovaries, are still more slackening in their growth. From this one must conclude, that the hormones controlling the development of

the masculine secondary sexual characteristics are not produced by the feminine gland. Moreover, the above mentioned experiment shows, that the secretion of the transferred feminine gland even retards the development of those peculiarities. This depressing action shows itself, for instance, on the growth of the operated animals. A larger growth and stronger skeletal development indicates in rats as well as human beings, a characteristic masculine sign. Thus it is shown, that the operated males lag behind considerably in their growth compared with the normal males or even with the castrated animals.

Second, under the influence of the transplanted ovaries, the castrated animals gradually develop in their physical constitution as well as their psychical sphere such peculiarities, as can be explained in no other way, than by the appearance of numerous feminine sexual signs. (Illustration 15). Thus, in the male with transplanted ovaries the shape of the head, general behavior, and even the properties of the skin change entirely. The long stiff hair of the male is changed into the soft, short, tender hair of the female, so that by a simple passing of the hand over it, one can readily distinguish such an operated male from his brothers. At the same time one can notice the deposit of subcutaneous fat, characteristics of the female, and what is still more interesting, the strong development of the breasts are in no way different from those usually observed in the normal females. Besides, under the influence of an increased action of the transplants, the mammary glands of such "feminized" males are considerably larger in their size and glandular development than those of the virgin females, and remind one more of the breast of the pregnant. (Fig. 16). Such animals gave milk and fed the newlyborn, toward whom they behaved with motherly attention and care. (Fig. 17).

Of particular interest in the experiments is the fact, that in the "feminized" males there is observed such changes in their behavior, as fully correspond with the naturally born females. Steinach further shows, that to

such "feminized" animals even the real males begin to pay particular attention in just the same manner, as they do to the females in general. In other words, the "feminization" of the males reaches such a marked degree, that it is deceiving even to the real males.

It is evident that all the experiments described above can be explained only by the fact, that the ovary is secreting certain chemical substances, which after entering the blood, evokes in the animal the development of the secondary sexual characteristics.

After removing the glands transplanted in the males, and examining them under the microscope, Steinach found that the ovarian cells had perished almost entirely. On the other hand, however, the interstitial tissue, i. e., the "gland of maturity" was powerfully developed. This proved beyond doubt, that the real cause underlying the development of the secondary female sexual characteristics in the "feminized" animals is not the reproductive part of the transferred gland, but the interstitial tissue possessing the specific internal secretion.

Later Steinach succeeded in carrying out a reverse experiment. A young castrated female was masculinized i. e., it acquired the appearance, signs and characteristics of a male, by transplanting under its abdominal skin male testicles. Here the masculine "gland of maturity" transplanted and growing had entirely changed the organism in its sexual relation as a result of the action of the specific hormones. The development of the female sexual characteristics appeared, after the transfer of the testicles, markedly retarded. The growth of the skeleton, however, had increased like that of the male. The skin, the shape of the head, general size, and other indications, became entirely masculine. (Illustration 18). The specific action of the hormones of the transplanted testicles showed their influence also on the nervous system of the operated animal. It became markedly erotic, according to the origin of the transplanted glands, i. e., Masculi Generis. In such a "masculinized" female

there appeared a typical masculine sexual behavior, in the sense of paying particular attention to the female, and constant fighting with the males.

And here also a thorough investigation of the transplants disclosed an almost complete degeneration of the reproductive part of the gland, i. e., the seminiferous tubules and a striking development of the interstitial tissue, which must be, therefore, recognized as the cause of all the changes.

In this manner Steinach succeeded in changing voluntarily males into females and females into males. This also proved Steinach's hypothesis of the sexual specificity of the "gland of maturity". Masculine sexual hormones evoke only the development of male characteristics and suppress those of the female and vice versa. In this sense, we speak not only of the specificity of the male hormones, but also of their mutual antagonism. This fact, as we shall see later, plays a very important role in the evolution of the numerous phenomena observed in every day life

The result of Steinach's experiments with the transplantation of sexual glands into castrated animals of either the same or opposite sex were afterwards splendidly proven in a bio-chemical way, namely: Hermann succeeded in extracting from the ovaries a fatty substance containing the female sexual hormones. Injecting 0.01-0.06 gms. of this preparation into an eight week old rabbit, Hermann produced such a marked development of the sexual organs and the secondary sexual characteristics, as were observed in 25 to 30 week old females and only during pregnancy; Four and five injections were sufficient to obtain a clearly expressed effect. The breasts rapidly developed. They accumulated a secretion, which could have been demonstrated on pressure. Not content, Hermann, decided to try out this preparation on castrated males, hoping for the same results gained by Steinach in his tests with the transplantation of female sexual glands into males. These experiments were fully confirmed. With this bio-chemical preparation he succeeded in ob-

taining in the castrated males, the splendid development of female secondary characteristics. In this manner Hermann's experiments have once more confirmed Steinach's tests of the changing of sex.

A still more striking corroboration of Steinach's tests are found in the experiments of the surgeons Sauerbroock and Heyde. They worked out the following special method, known under the name of "parabiosis". Two different animals are sewn together in such a manner that a complete union takes place, and consequently a complete mixture of their circulation. This method is successfully employed, for instance, in the study of the internal secretion of the pancreas. We have pointed out above, that when the pancreas are removed, the animal will show all symptoms of diabetes However, if such an animal, deprived of its pancreas, is united by the method of parabiosis with another normal animal then the diabetes in the operated animals disappears. This can only be explained by the fact that the hormones of the pancreas of the healthy animal are penetrating, due to the common circulation, into the body of its diseased partner, and by their action prevent diabetes and its consequences. That it is really so, is proven by the next phase of the same experiment. When the two "grown together" animals are divided, all the symptoms of diabetes will soon reappear in the one lacking its pancreas. This particularly interesting method of parabiosis was successfully employed for the verification of Steinach's experiments with transplants. The animal, deprived of its sexual glands and showing all symptoms of a typical castrate, is sewed together with another normal animal of the same sex, according to the method of parabiosis. If Steinach's views of the role of the sexual hormones in the development of secondary sexual characteristics are correct, then the consequences of the castration, under the influence of hormones contributed to the blood by the healthy partner should disappear. Facts have confirmed this supposition. In the succeeding experiments, the castrated animal was sewed, according to the method of

parabiosis, with another normal animal, but of opposite sex. If Steinach's assertion about the specific action of the sexual hormones is correct, then the castrate, under the influence of the hormones coming from its healthy neighbor, should develop the corresponding secondary characteristics of the opposite sex. This supposition also was successfully demonstrated, and the artificial changes from male into female, and vice versa became possible not only by means of glandular transplantation, but also by the methods of parabiosis.

So great is the power of proof of the above mentioned experiments with parabiosis, so clear is their scientific truth, that the strongest opponent of Steinach's works, no matter how vehemently he may denounce their significance, must bow before it.

Furthermore, we must admit that these experiments, in the face of their over-whelming proof exceed even those performed by Steinach with the transfer of the sexual glands.

It is interesting to note, that parabiosis is found in nature. The mixing of the circulation of two animals, has been observed for a long time in a particular form of monstrosity, when twins are born, and grown to each other by some part of the body. Such an instance, was at one time the very interesting case of the twin sisters Blascheck, attached to each other by their backs. From the biological point of view, one episode of the two sisters intimate life is particularly interesting. In one of them, Rose, there was noticed an increase in the circumference of her abdomen. In view of a supposed pregnancy, it was decided to call a physician. However, the girl categorically denied it. Her sister, faithful and involuntary companion, and, therefore, the most competent witness to Rose's intimate life, also excluded the possibility of pregnancy. However, after a short time Rose happily delivered. And here appears the most curious fact, the mother's breasts, as well as those of her sister, simultaneously produced milk. This phenomenon is now quite clear to us. The milk in the breasts is produced by a

sexual hormone, which developes its action after the delivery. It is obvious, that the hormones, which were formed in Rose's body, were also transmitted through the common circulation, to her sister, resulting in the appearance of milk.

As a good illustration of Steinach's experiments, excellently confirming the deductions made on the basis of his works, are the observations of the American Zoologist Lillie, who refers to the existence of parabiosis in nature.

As it is known, the cow gives birth to only one calf, seldom to two at a time. In case of the latter the born twins may be of the same sex or may belong to two different sexes. (Naturally, they must come from two separate ova). Then appears the extremely curious fact known from our every day life, that in case of twins (of different sexes) the female is usually not reproductive.

Taking into consideration Steinach's data, with the view of investigating this strange fact, Lillie examined 40 pregnant uteri, in each one of which there were twins in various stages of development. In twenty-one wombs, he could distinguish, that both embryos belong to two different sexes, presenting the very case, which was to be explained. The anatomical fundamentals discovered by Lillie consist of the fact that there is a complete union between the blood vessels of both embryos, so that a colored fluid injected into the blood vessels of one fetus, will invariably enter into the body of the other, (Figure 19). From this it follows that all the substances, circulating in the male embryo, are directly transmitted into the other twin, i. e., into the female. But we know that the sexual glands produce certain substances, exercising a most powerful influence on the development of all the so called secondary characteristics. It was shown above, that by transplanting the ovaries, Steinach succeeded in changing the sexual appearance of a young male guinea pig, into a female and vice versa. Lillie sees the same phenomenon in the twins of a cow. Here the female sexual organs, for some unknown reason

seem to have no action on the seminal glands of his twin-male. However, the masculine hormones circulating in the blood vessels of the male, and entering directly into the female twin, due to the common circulation, cause, as might have been expected, according to Steinach (antagonism of the male and female hormones), a complete underdevelopment of the ovaries. This fact is responsible for the resulting sterility of the full grown cow.

Still more striking, in Lillie's investigations, appears to be the following: In three cases Lillie noticed an exception to the general rule. In the female of sexually different twins the ovaries were fully developed and not a trace of detention of growth could be disclosed. But here again, contrary to the general rule, the after-births were distinctly separated and consequently the male hormones could not penetrate into the female partner. (Figure 20). These three instances of exceptions to the general rule confirm most convincingly the previously made deductions.

The observations of Lillie were quoted, of course not with the object to prove the relation between the development of the secondary sexual characteristics, and the hormonic influence of the reproductive glands. Steinach's experiments, one especially, with the confirming proof of parabiosis, speak so eloquently for themselves, that they leave no doubt as to their truthfulness. However, in the consideration of Lillie's investigations, we had in view only to show, how original at times are the ways and means science is employing to prove certain conditions.

Another queer picture is sometimes produced by the same caprice of nature. I have in mind an extremely rare case of spontaneous change of sex. Also here is particularly striking the effect of the coincidence of the above mentioned sexual changes with the period of sexual maturity. Apparently, in the sexual gland at that time, corresponding biological changes take place, which lead sometimes to a complete metamorphosis of the gland. One such instance is demonstrated by the accom-

panying photograph. (Figure 21). There is represented the daughter of a merchant, Leopoldine Zahn, who up till sixteen years of age was brought up as a girl and felt as such. On her seventeenth year she experienced very deep changes that have turned her entire being into a male. As a result, she shortened her name from Leopoldine to Leopold and in general continued to live the life of a man.

CHAPTER V

THE PROBLEM OF SEXUAL ANOMALIES AND ITS SOLUTION BY STEINACH

In the previous chapter we became acquainted with Steinach's experiments, by which he voluntarily changed the sex of the animal, turning its masculine appearance into that of a female, and vice versa. The experiments give us a closer view of the real nature of these characteristic peculiarities, by which one sex is distinguished from another. They furnish us with more correct means to predetermine, according to our judgment, the secondary sexual characteristics of the organism, directing its development into masculine or feminine channels.

But Steinach was not satisfied with this, and he continued to dig deeper and develop the results already attained.

The next question Steinach asked himself was the following: what if into the castrates were transplanted not one gland of one or another sex, but the gland of both sexes? How will such a castrate develop? What sexual characteristics will it attain? Will the hormones of both glands produce male and female sexual characteristics simultaneously? Would not the operated animal grow up an hermophrodite in the fullest sense of the word? Will he succeed in this purely experimental way in producing bisexual beings? Is it not possible to produce homosexuals artificially?

All these problems of Steinach were solved by experiments in the most satisfactory manner.

In his experiments on guinea pigs, Steinach transplanted simultaneously a testicle and ovary into young males, previously castrated, and, therefore, rendered them sexually neutral. The glands developed under the same conditions had the same chances for growth and activity.

And as might have been expected, the glands took root and strongly developed their interno-secretory parts. i. e., the "glands of maturity". The reproductive parts underwent a complete atrophy. The growing and developing "glands of maturity", began to show their specific influence, producing a real bisexual animal, both physically and "mentally". Moreover, Steinach succeeded in establishing the exact relation between a greater development of male or female transferred glands, and a corresponding tendency of the sexual instinct in the operated animal, i. e., the attachment toward the male or female. Steinach further called attention to the fact, that the very same animal operated on in the above mentioned manner, conducting itself differently at different times, betraying sexual attachment at one time to the male and at another to the female.

In his further experiments Steinach attained still more interesting results. After transferring into the castrates, i. e., sexless beings, a combination of various quantities of male and female glands, he obtained a series of animals in various stages of development of male and female secondary sexual characteristics. He could place them in one long row in which would appear a gradual decrease of the masculine and a gradual increase of feminine sexual features, depending on the quantity of the transplanted glands. The two extremes of this series would be the animals at one end with markedly predominating male sexual features, and at the other end those with female sexual features. This corresponded in direct ratio to the quantity of transplanted sexual glands. Between the two extremes, there was an intermediate stage, in which the predominance of either the male or female secondary sexual characteristics always strictly corresponded to the difference in quantity of the transplanted glands. This exact ratio between the transplant and the corresponding development of hermaphroditism in animals, once more confirms Steinach's data, leaving no doubt of the correctness of his deductions.

These experiments explain to us the conditions some-

times found among human beings, known as hermaphroditism. In these cases we frequently see a complete similarity to the above described bisexualism, artificially produced by Steinach in guinea pigs. Such a case is presented in Figure 22. At the first glance--the hermaphrodite gives the impression of a normal woman: well developed breasts, absence of hair on the body and extremities, etc. Brought up as a girl, she married, but soon consulted a surgeon for the purpose of changing by means of an operation, the abnormal external appearance of the genitals. Investigation disclosed that the patient possessed masculine genital organs. Involuntarily, our attention is attracted by the similarity in the development of the breasts and external genitalia in the hermaphrodite to a corresponding condition in a guinea pig, produced artificially by Steinach's co-workers, according to the above described method. (Figure 23).

Steinach's experiments with artificial hermaphroditism throw a light on a comparatively frequent occurrence of homosexualism among animals. In his opinion, this appearance is also explained by the presence in the organism of a bisexual gland, producing both male and female sexual hormones. A weighty argument, in favor of this supposition, Steinach considers the observations he made on goats. Among the latter there is frequently an abnormal sexual tendency. Steinach describes quite a characteristic case of such a homosexual goat, which apparently possessed a normal female shape normally developed external sexual organs, but showed entire indifference towards the males and made constant attempts to possess the females. Examining under the microscope the sexual glands of this goat, Steinach could establish in their structure a deep deviation from the normal. (Figure 24). They disclosed a mixture of male and female elements, which apparently have contributed to the blood of the animal, not only the feminine, but also the masculine hormones. The latter must have rendered the brain of the above described goat erotic in character resulting in a homosexual tendency.

Following up these observations on the sexual "mentality" of the experimental bisexual animals and after confirming them with the described results, Steinach decided to compare these data with instances among human beings. He thought that men also have exceptions in their psychical development. The comparatively frequent appearance of homosexualism among human beings, is also explained by the presence in the organism of a bisexual gland of maturity producing both masculine and feminine hormones. In such cases, the hidden homosexualist may, for years, make the impression of, and generally feel like a man. However, should the masculine interno-secretory cells (producing the male hormones) for any reason lag behind in their development and activity, then the other part of the gland--the feminine, in view of the weakening of the antagonist, begins to develop strongly and to produce a greater amount of specific female hormones. Under the influence of the latter, there may appear on one hand a series of female secondary sexual characteristics, like increase in the size of the breasts, rounding out of the body etc. On the other hand, under its influence comes the central nervous system, making the individual erotic in an abnormal direction. The result is an abnormal sexual tendency, i. e., homosexualism.

In an attempt to verify his hypothesis regarding the origin of homosexualism among men, Steinach examined under the microscope the testicles of several male homosexualists, and in all cases he could show that there was a considerable deviation from the normal in the structure of the investigated sexual glands. First his attention was attracted by the marked atrophy of the seminiferous tubules which were divided by an intermediate tissue into unequal parts. A still greater disturbance was shown, according to Steinach, in the development of the interstitial tissue. The disturbance of Leydig's cells disclosed signs of degeneration. On the other hand, there were found a group of cells which are absent in a normal

male gland. They differ from the Leydig's cells in their size, large amount of protoplasm, and number of nuclei. They stain poorly and only seldom contain crystals which are usually found in Leydig's cells. However, Steinach's attention was attracted by the similarity of those cells in shape and size. The cells that make up the female gland of maturity—Steinach called the F cells to differentiate them from the masculine interno-secretory M cells. (Fig. 25).

From all those investigations, Steinach concludes that the abnormal interstitial cells found in the testicles of the homosexualists, are in their nature and vital activity entirely equal to the female cells. They produce female sexual hormones that cause the brain to erotize in a corresponding abnormal manner.

However, one must admit the last mentioned observations of Steinach are not confirmed by any other investigators. Many scientists deny any specific significance of these F cells, considering them a result of a poor hystological preparation and calling them "double Leydig's cells". In Steive's opinion, these F cells can be found in a greater or lesser number in the testicles of any sexually normal man. Harm finds no changes in the interstitial tissue of homosexualists, except a marked retrogressive development of the seminiferous part of the gland. Apparently, Steinach made his deductions somewhat too hastily, concluding on this ground that the cells he found are identical with those of the female organs. Nevertheless, this does not diminish in any way the significance of the general fact established by Steinach, namely, that the sexual gland of the homosexualist shows a whole series of characteristic deviations from the normal. This undoubtedly speaks in favor of the theory of an internal secretory origin of homosexualism.

Following Steinach's data his co-workers, Lichtenstern of Vienna and Professor Musham of Berlin, made an attempt to treat homosexualism by operative means. If Steinach's theory is correct, they reasoned,

if homosexualism really depends on a double "gland of maturity", then the removal of the abnormal sexual gland, and the transfer into its place of a testicle of a healthy individual with normal sexual desires should result in a cure from homosexualism, and complete removal of all the abnormal sexual tendencies. These suppositions were fully justified. In eighteen cases of homosexualism, Lichtenstern had recourse to operative interference and received wonderful results. Thus having removed from the patient his sexual glands, Steinach transplanted into the abdominal muscles of the patient the gland of a young healthy normal man, and the transferred gland took root. After several weeks a marked change was noticed in the sexual life of the patient. The feminine peculiarities disappeared, his sexual desires were then always directed towards the opposite sex.

Particularly illustrative is the following case of Lichtenstern. In 1916, he had an occasion to observe a homosexualist whose both sexual glands had been removed a few months before, because of a tubercular infection. Notwithstanding the removal of the diseased organs, the patient still preserved the female sexual indications (the breasts, general shape of body, femininity in character). His abnormal sexual desires, tho somewhat weakened, still persisted after the removal of the glands. To explain this peculiarity from the view-point of his theory, Lichtenstern examined the patient more thoroughly. It was disclosed that on the right side, a small piece of the testicle, the size of a nut had been left. The persisting signs of homosexualism, were then explained. Apparently, the remaining piece of testicular tissue continued to produce the female hormones, which caused the abnormal sexual desires of the patient. In order to verify this hypothesis, Lichtenstern removed the remaining piece of the testicle and into its place transplanted a normal gland of a healthy man. All

signs of homosexualism then entirely disappeared. The sexual tendency became normal i. e., heterosexual. The patient soon married and according to his own acknowledgment was very happy. This case can hardly leave any doubt as to the real nature of homosexualism.

Similar operations were performed in Berlin by Professor Muhsam and the results attained were favorable. For example, he had an occasion to operate on one medical student who was subject to homosexualism for a long time. Interesting from the biological standpoint is the fact, that the brother of the patient was also a homosexualist. That undoubtedly speaks in favor of a congenital character, and consequently a biological basis, underlying this condition. The patient took part in the last world war, was an officer in the army, and while he was at the front, when in the presence of young men he had frequently endured such sufferings on account of his abnormal sexual desires, that once he made an attempt to commit suicide. Being a medical student he treated his defect conscientiously and was continually trying, as much as it was in his power, to overcome the abnormal tendency, but he was not always successful. The society of women he did not like. The most beautiful woman never excited in him any sexual desires. But the sight of handsome young men brought about a condition of the highest sexual excitement. In view of a very pronounced homosexualism, Muhsam decided to remove the abnormal testicle. At the same time he transplanted into his abdominal muscles a testicle of a healthy eighteen year old boy. As early as five or six days after the operation the sexual "psychical attitude" of the patient entirely changed. While before the operation the sight of the other man in the ward, where the patient was, produced a strong sexual excitement, these abnormal feelings disappeared entirely after the operation. But instead there appeared clearly expressed desires for persons of the opposite sex. After a short time the patient fell in love with a young girl. Men stopped to interest him entirely

a b c d

Illustration No. 15.

Feminated male guinea pig.

a. Feminated male. b. Castrated male.
c. Normal brother. d. Normal sister.

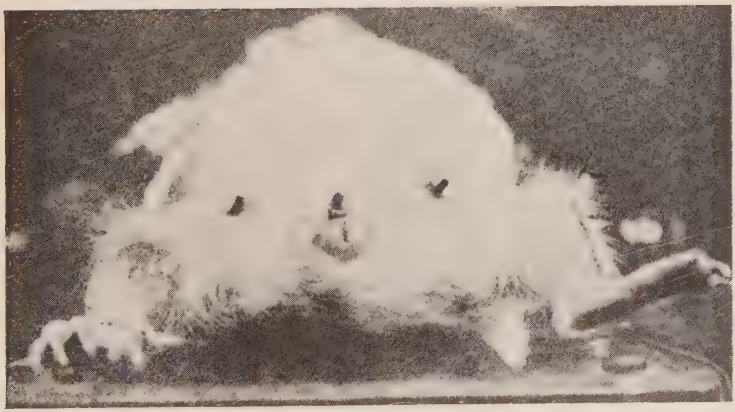


Illustration No. 16.

The breasts of a feminated male guinea pig.

Illustration No. 17.

Feminated male feeding young ones.

a b c d

Illustration No. 18.

Masculinization of a female guinea pig

(a) Masculinized female. (b) Castrated female.

(c) Normal sister. (d) Normal brother.

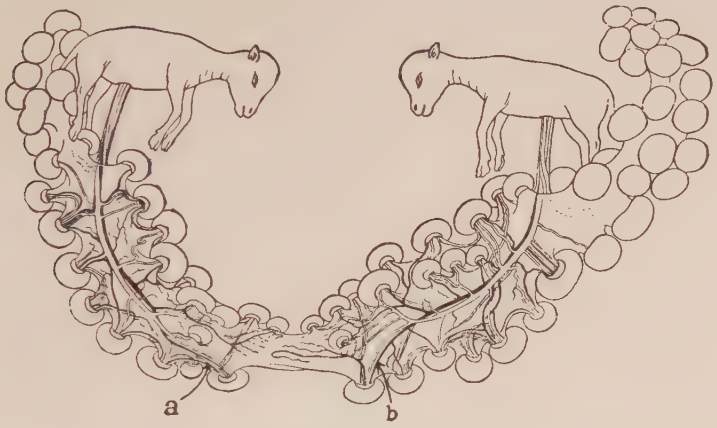


Illustration No. 20.

Twins (after Lillie) here the bloodvessels are not united

A and B do not anastomosa.

Illustration No. 21.

A case of spontaneous change of sex on the seventeenth year of age

Leopoldine, later Leopold Zahn, daughter of a manufacturer in Viena.

(a) Leopoldine Zahn at the age of ten.

(b) Leopold Zahn at the age of seventeen.

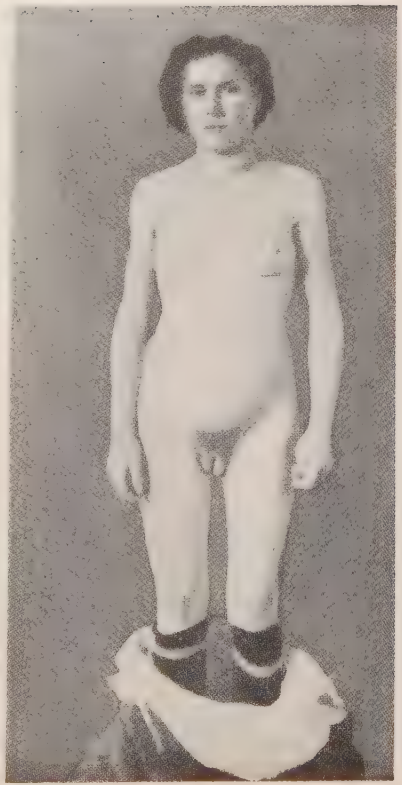


Illustration No. 22.-23.

Natural and artificial hermaphroditism

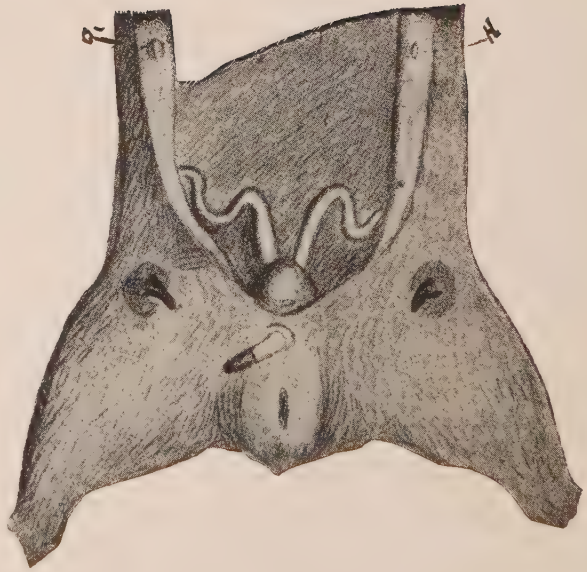


Illustration No. 23.

A case of simultaneous transplantation of a testicle and ovary into a male guinea pig. The photograph was taken three months after operation. The external genitalis, as well as the breasts, producing milk, were well developed. (After Sand).

Illustration No. 22.

Hermaphrodite

(From the collection of Magnus Herschfield).

Here also may be seen the beneficial and marked influence of the operation on the character of the "sexual psychology" of the patient. This case is still more important, in view of the fact that the observations were made on a conscientious, medically educated man, who treated his inner life with the highest critical sense, and could make a very delicate analysis of all his feelings before, as well as after the operation.

In this manner, the tests, dealing with the treatment of homosexualists are attaining an enormous theoretical interest, being a self-evident proof of the correctness of Steinach's views as to the nature of homosexualism. Their practical significance is of colossal importance, as it gives us definite means for a successful treatment of homosexualism in all its manifestations.

However, one ought not to become too optimistic. The fact that the few cases reported by Lichtenstern and Muhsam, were followed by wonderful results does not necessarily prove that in all other cases the beneficial action of the operation will come so soon and so easily. On the contrary, at present, this appears to be quite improbable, and we are rather inclined to believe that a more or less successful result of the operation depends to a considerable extent on the length of the period, during which the organism was subjected to homosexualism, to the abnormal action of the bisexual gland. The manifestations of homosexualism, as an unnatural sexual desire, depend on the establishing in the brain under the influence of the bisexual gland, an abnormal response, or, to be more exact, unnatural sexual reflexes (Ishlondsky). If these reflexes had been repeated a number of years before the operation, then it can be easily understood that even with the removal of the sexual gland, they would disappear entirely. That is why it is necessary to continue after the operation, with a long period of treatment to destroy the abnormal sexual reflexes and create new and normal heterosexual nerve paths. If this is true, then the cases of Lichtenstern must be recognized as particularly favorable. But we must expect

cases, less responsive and more difficult. Some time ago, right after the publication of the works of Lichtenstern and Muhsam, I expressed these views, which, later enlarged and developed, were presented before the International Congress of Sexual Biology in September 1921. There the surgeon Stabel from Berlin, as if wishing to illustrate the opinion I had expressed, reported six cases operated for homosexualism, where the results had not justified the expectations. I had stated that Stabel's failures were quite explainable. The operation should have been followed by a prolonged treatment.

The practical significance of the operative transplantation of sexual glands is not exhausted by the treatment of homosexualism. It must be understood, that in all cases, where the function of the testicles is lowered, and in cases where the testicles are entirely removed as a result of some diseased process, the transfer of a healthy, normal gland will prevent all the consequences of castration, which otherwise would inevitably follow. The threatening of eunuchoidism will disappear entirely under the influence of the transplants. The results obtained in such cases by Lichtenstern and Muhsam speak for themselves. A striking illustration of the above is the following case of Professor Muhsam.

In a twenty-five year old man, Muhsam removed both testicles infected by a tubercular process. As a result, the sexual desires began gradually to diminish, and finally entirely disappeared. The growth of hair on the patients' face and body began to fall out, his voice became high pitched, similar to that of a woman, the shape of his body became rounded, as a result of an excessive accumulation of fat in the subcutaneous tissues. In short, all the consequences of castration were apparent. In April 1918, Professor Muhsam transferred into this subject a healthy sexual gland, which took root and began to function in its new place. The consequences of castration began to disappear gradually. The voice again became lower, masculine, the mustache and beard reap-

peared. In March 1919, the patient married. In April 1920, Professor Muhsam had another opportunity to observe him. All the male sexual characteristics were fully developed. The excessive amount of fat disappeared entirely, and the shape of his former patient's body became typically masculine. In all his actions, he saw a manly self-confidence. The patient considered himself a happy married man, and according to his own words he mastered his profession as a blacksmith successfully and equally well responded to his obligations as a husband.

The above mentioned case shows once more the great significance of the operation. It is true, that even these means, advanced by Steinach for the treatment of sexual anomalies has some, though only temporary defects. The scope for the application of this operation is, at the present time, extremely limited, for very seldom can there be found at the surgeon's command the required material for transplantation. It is clear, that no one can be found, who would voluntarily sacrifice this original material. The surgeon must wait with his operative interference till such time when chance will send him a patient, who may have his testicles removed. Such chances, of course, are extremely rare.

It is true that this circumstance also plays only a temporary role, and in the future in this field too, new vistas will be opened. Here I have in view the culture of organs outside of the organism, brought into science by Carrel, a method, which is still in its early stage of development. This method offers the possibility of supporting for a certain period of time, the activity of an organ or tissue, after it has been removed from the organism. Thus, one may succeed for many days or even months to support outside of the organism, the life and correct beating of an excised heart. The heart of a chick, for example, placed in a specially prepared nourishing medium, was contracting rythmically like a living clock for one hundred days. When these contractions became

feeble and faulty, the washing with a new nourishing fluid, restored to the heart its previous energy. A more interesting experiment was conducted by Prof. Kuliakco in Tomsk. From the bodies of children, who died from diphtheria, he excised the hearts, 12 to 24 hours after death, and placed them in an artificially prepared nourishing fluid, supplied with a sufficient amount of oxygen. In this way Kuliakco could not only restore life to these hearts, but could maintain their beating and rythmic contraction for a period of many hours or even days. These tests show beyond any doubt, that separate organs and tissues may continue to live for a long time, after the organism, to which they belong, has perished. But particularly important is the fact, that the organs, kept outside of the body for many days or months, when transplanted into another animal, take root there as well as the recently excised entirely fresh organs. Thus, pieces of transferred veins lived and grew after they had been preserved for months outside the organism. It is only a question of time when the same results will be attained for all the organs of our body, even the most complicated, like the various glands of internal secretion. When this is achieved, the problem of treating sexual anomalies, by means of transplanting of healthy glands, will enter into a new phase of development. Then the surgeon will not have to wait for favorable chances, to have at his disposal the necessary material for transplanting. He will always have a sufficient supply of glands, previously, excised from the organism and then artificially cultivated under special conditions. A great deal may be also expected from the transplantation of glands from other animals into humans, so far unsuccessful, but which will be fully realized in the future. To this question we shall return later.

CHAPTER VI

SEXUAL ANOMALIES IN OUR EVERYDAY LIFE IN THE LIGHT OF STEINACH'S WORK

Steinach's test with transferred sexual glands, especially the experiments with the voluntary changing of sex in animals, his latest work with the artificial reproduction and operative treatment of sexual anomalies, explain to us their nature and origin.

Thus, they throw a light on one interesting sexual anomaly, whose rare appearance is seldom made the object of observation. However, the less pronounced form of this condition, is frequently met with in our daily life.

I have in view an anomaly diametrically contrary to the manifestations of sexual deficiency described above and consisting of an unnaturally early and powerful sexual maturity.

Such instances have been known for a long time. There are cases, where menstruation began in girls one to two years old, with the regular menstrual appearance every four weeks. It is interesting that in some such instances the diseased condition of the ovaries could be demonstrated, most frequently in cases of new-growths. The presence of the latter caused, for some unknown reason, an increase of function of the interno-secretory part of the affected ovary. A similar case of increased function of a gland, as a result of swelling, as mentioned before, when discussing the role of the pituitary body in the organism.

Particularly important and interesting appears to be the fact that the removal of the disclosed new-growth (tumor), or swelling, from the ovary, stopped the menstrual flow and the grown hair around the genitalia disappeared.

Another interesting case of a premature sexual development, clearly illustrating the physical changes under observations, was described by Obman and Magnus Herschfield.

The case in question concerns the four year old boy Robert E., the son of poor peasants. At his birth Robert had a perfectly normal appearance. When the boy was about a year old, the mother noticed a heavy growth of hair around his genitals and when the boy began to talk the general attention was attracted by the low tone of his voice, which was much like that of an adult. Beginning with his second year, the boy began to grow very rapidly. And the mother noticed again that his genitals developed differently from those of other children. However, there was no indication of any sexual excitement.

Robert did not like to play with other children, acted more like a grown up, spent his time with older people. His favorite pastime was to hitch and unhitch the horses. The entire day he remained in the field. In general the boy was good natured. At times, irritable and stubborn, he was obedient only to his father. Mentally, Robert was very well developed and was more alert than any of the other children.

Dr. Obman, who was the first to examine the boy more thoroughly, says that when he saw Robert in bed, he received the impression, that there was before him not a four year old boy, but a grown up, although a very short man. The boy was 121cm., in height, weighed, nude 34kgm., (normal weight of a child at this age is 14kgm). The skeletal system and musculature were powerfully developed, and fully corresponded in their size to those of a 14 year old boy. As proof of his muscular strength the following fact may serve as an example. Robert without any effort could lift one handed, a baby weighing 26 pounds.

Robert's head was unusually large, 58½ cm., in circumference (normal is 45 cm). However, in structure, his skull, especially in the region of the sella tursica

(Turkish saddle), where the pituitary gland is situated, the X-ray could not establish any abnormal growth.

The genitals corresponded to those of a 16-18 year old boy. His voice was low, similar to that of a grown up man.

Very interesting from the biological standpoint, is the fact that in order to produce complete anasthesia, he required as much chloroform (for he submitted to an operation) as a man of mature age. Nevertheless, as a marked contrast to his general physical development and entire constitution, he still retained his milk teeth.

A careful investigation of the internal organs did not disclose anything abnormal.

Magnus Herschfield had an occasion to observe the boy at his village during the last war, when the boy had just passed his fourth year. In the yard of the house, where the boy lived, he noticed a stalky fellow loading manure. This was Robert. Like a mature farm hand, he managed his work with dexterity. His older brothers, nine and thirteen years of age, looked a great deal weaker and younger than their four year old brother who could easily lift both of them in the air. His low voice attracted so much attention, that the entire village loved to tease him. This made him quite irritable. On closer examination, Herschfield, could confirm Obman's data as mentioned above. Also Herschfield's attention was attracted by the boy's unusually developed genitals, which were typical of a full grown man. "He has been that way for the last two years", his mother remarked.

This case of early sexual maturity is easily explainable, if we take into consideration the data of Steinach's works. Apparently the glands of maturity began to develop and function too early, producing the specific sexual hormones in great quantity. The latter entered the blood in abundance, causing those deep changes in the function of the organism, which were entirely disproportional to his growth.

The present case is particularly interesting in that it

illustrates marked constrasting characteristics.

Thus, the hairy growth around the genitals is strongly developed, while under the arm pits and on the lips there was not a trace of hair. The skeleton was powerfully developed, but his milk teeth were still preserved.

This peculiar contradiction must, apparently, be explained by the fact, that in the process of sexual maturity and in the development of the secondary sexual characteristics, except the undoubtedly dominating action of the sexual glands, also other parts of the interno-secretory mechanism must be participating, all being in close connection with each other. We have pointed out this fact before when discussing the consequences of the removal of the pituitary gland from the organism. Then, we could notice, with a whole series of many other disturbances, the appearance of sexual underdevelopment.

From this viewpoint, the marked contrasts in the physical development of Robert must be ascribed to the circumstances, that not all the glands of internal secretion were equally involved in the process.

Quite a few similar cases of early sexual development were described. More interesting and puzzling are the cases in which, even before sexual maturity took place, there appeared a striking development of secondary sexual characteristics, not of one, but of both sexes. One such case is shown in Fig. 26*. There is presented a nine year old child, who at birth appeared to be a perfectly normal girl. During the fourth year of her life, however, there appeared a growth of hair around the genitals and secondary masculine characteristics--mustache and a beard. The larynx, strongly developed, both in size and structure, corresponded to the larynx of a full grown man. In connection with this, the girl possessed a low voice. The musculature was powerfully developed. The hair on the head was 36 cm., long. The flat breasts and the nipples were of masculine nature. The skeleton

*This photograph I obtained thru the kindness of Dr. Magnus Herschfield, who had the case under observation a few years ago.

was less strongly developed and according to the degree of ossification, corresponded to that of a 16 year old boy.

Regarding the mental attitude of Jadevig, the female characteristics clearly predominated. She would rather play with dolls than with horses, she was very bashful and in general behaved like a girl.

Reviewing this case we see that the nine year old child possessed a series of masculine features, like the beard, the characteristic size and shape of the larynx, masculine breasts, muscular system and skeleton, and at the same time, with all these, the female indications.

This case of abnormal sexual development became quite clear from the standpoint of Steinach's experiments. Here apparently, a bisexual gland, demonstrated its action, where the masculine cells, for some unknown reason had suddenly suffered a marked development, resulting in the marked bloom of male secondary characteristics. At the same time, also the female indications began to develop quite normally and the result was a hermaphrodite. This reminds us of those conditions artificially produced by Steinach and Sand, in guinea pigs and rabbits.

In these cases of early sexual maturity, the premature development did not affect the specific sexual mental attitude, i. e., the sexual desires. Nevertheless, there are some cases on record, when with the characteristic physical indications, there was developed a tendency towards persons of the opposite sex. Lastly, there are other cases on record, where prematurity appeared only in the psychology of the individual, without establishing any noticeable changes in the physical side. There are some cases described, where sexual intercourse occurred among children of 4 to 10 years. Montgomery, for instance, a girl in whom menstruation appeared during her first year, gave birth when she was ten years old. Molitor describes the case of a girl around whose genitals he noticed hair at birth. After four years the girl began to menstruate regularly. Beginning with her eight year she had sexual intercourse, and at nine years gave birth.

In the case of Carusa, the girl began to menstruate when two years old, at the third year, the hair around her genitals appeared and at eight she became pregnant.

Martin describes a case when a woman at the age of twenty-six became a grandmother, and Lotie of Greece, met one mother at the age of twenty-five with a daughter of thirteen.

Similar observations of prematurity are made among animals.

All those cases of advanced sexual maturity, physical as well as psychical, may be clearly explained by Steinach's data. They are a result of an early development and an increased function of the interno-secretory part of the sexual glands. Nevertheless, we should take into consideration the role, which other parts of the interno-secretory mechanism may play, both in cases of excessive, as well as deficient sexual activity. This is of particular importance, for as we have already seen, the endocrine glands are united into one system, whereby, the change of one link of the chain may have a decided influence on the function of the sexual glands. Similarly the disturbances in the activity of the latter may equally interfere with the normal action of any other gland. To this question we shall return later.

A very interesting anomaly which finds for itself a direct explanation in Steinach's data is the mysterious appearance of indications of the characteristics of the opposite sex, in either men or women, who had been entirely normal up to a certain time. Thus in the case of one patient of Prof. Gollardo, a woman of middle age, mother of four children, having a perfectly normal appearance, suddenly experienced a cessation of her menstruation, the breasts began to diminish markedly and a mustache and beard began to grow. Gollardo found a cyst of the ovary, which he removed. After this all her masculine indications disappeared, and she resumed her former feminine appearance. For the explanation of this mysterious occurrence, we have to take into consideration the following. Until a certain

period of development, the embryo of the animal appears in the sexual sense entirely neutral. Only at that moment, when the differentiating of the sexual gland of the embryo, male or female, takes place, the future animal takes on the peculiarities of either one or the other sex. However, the sexual gland develops from the indifferent protoplasm, which contains in itself all the elements for the development of both the masculine and feminine glands. At the moment of differentiation, one of the elements markedly predominates over the other and the gland develops into either masculine or feminine. If the predominating influence is shown by the male element over the female, then the gland will be masculine in character and the sex of the future animal consequently will be masculine with all its secondary male sexual characteristics. If, on the other hand, the female elements predominate, then the developing gland will acquire a feminine appearance and the sex of the animal will follow accordingly. And lastly, if the sexual nucleus of the glands do not fully differentiate, and both male and female elements develop more or less equally, then the result is going to be a bisexual gland, which results in the appearance of a bisexual animal (hermaphrodite or homosexualist). From this picture of development of the sexual glands can be seen, that a complete differentiation never takes place, but that even normally one set of elements exerts a predominating influence over the elements of the opposite sex, but that the latter are still in the gland, although in a dormant and depressed condition. It is obvious that during our entire life we carry in our sexual glands dormant cells of the opposite sex.

From this standpoint the case of Prof. Gollardo, as well as the other instance of sexual anomaly, can be easily explained. Apparently, in Gollardo's patient, the presence of a swelling in the gland, depressing the activity of the normal feminine elements of the ovary, evoked to life the dormant masculine cells, which were preserved in the ovary from the time of its differentiation. These

masculine cells began to develop rapidly and contributing the specific male hormones, produced the appearance in the patient of the male secondary sexual characteristics. The female indications under the influence of the male hormones consequently began to weaken and became almost extinct. In this manner, in the light of Steinach's theory, the mysterious case of Prof. Gollardo is easily understood.

Thus, Steinach's experiments make it quite conceivable, that the origin of both sexes develops from the same rudimentary asexual form, which under the influence of the specific hormones from the sexual glands acquires the corresponding male or female characteristics. If we castrate the organism in early childhood and in this manner deprive it of the action of the specific hormones, then the typical secondary sexual indications do not develop and the organism remains in its original indifferent stage, only in an enlarged form. If, however, the castration is undertaken at maturity, when the secondary sexual characteristics have made their appearance, then, as we already know from Steinach's experiments, these characteristics will gradually vanish, so that the original form of an indifferent being will be exposed. This we find in all cases of late castration.

That is the reason the masculine and feminine castrates resemble each other a great deal more in their constitution than a normal male and female. Furthermore, the later the castration is undertaken, the deeper the secondary sexual characteristics "rooted" themselves in the body, the more difficult it is to disclose the asexual form. Therefore, the most marked effect is produced in the case of very early castration, when the secondary sexual characteristics did not begin to develop. Then the organism in its further development, free from the influence of the sexual hormone, preserves its "neutral" asexual form. This is particularly true among animals, especially birds. Here by an early castration one may produce such a type of a primitive asexual form, that it is

impossible to differentiate the castrated rooster from the castrated hen.

How, then, can we imagine a development from one rudimentary mass of such sharply differentiated organisms, such as the male and female appear to be? The process of this development, according to the data of Steinach's tests, appears as follows. The original asexual form consists of an enormous series of characteristics, which appear generally for both male and female. But when under the influence of the specific hormones, all these characteristics change. Some become more pronounced under the male hormones, and in their development suppress the female. The reverse holds true. When, however, the sexual hormones are not produced, the result is a characterless, sexless form. All these factors produce peculiarities, which differentiate one sex from the other.

The splendid tail and rich growth of feathers on the rooster for instance, are, as is known, his typical secondary sexual characteristics. They first play the role of an ornament, whose object is to attract the female; his spurs serve him as a means of defense and attack against his antagonists. It might be supposed that these typical signs develop under the influence of specific hormones. In the hen, however, there is not even a hint of the above indications. But if the hen were castrated, feathers and spurs will appear similar to those of the rooster. At first glance, this fact seems not only peculiar, but may shatter the very teaching about the development of the secondary sexual characteristics under the influence of specific hormones. And the question involuntarily arises, if the masculine signs are really developing under the influence of the corresponding hormones, then how can we explain the appearance of such typical masculine features, such as the spurs and feathers of the rooster in the castrated hen? It is true that such a hen is deprived of female hormones, but neither does she possess the male gland. Therefore, the appearance of masculine characteristics

after castration contradicts the theory. However, this contradiction is only on the surface. The fact is that the long spurs and rich feathers of the rooster, in reality belong to the general asexual form of chickens, on which the male hormones have no influence. This explains why these characteristics of a sexless shape are so well preserved in the rooster, and why, when the bird is castrated, these signs do not vanish, but remain in that shape, which is inherent in the asexual species. In the hen, however, these signs of indifferent form, under the influence of specific female hormones, are retarded in their development and they remain in the shape of a rudimentary nucleus. But should the hen be castrated, and the checking influence of the female hormones be thereby removed, the above mentioned nucleus of the neutral form will fully develop. From this standpoint, the long spurs and the feathers of the rooster are not really specific masculine characteristics whose development should depend on the action of corresponding hormones, but the signs of a general sexless form. In other words, the appearance of these features in the castrated hen should be explained not as a development of masculine indications, but as the reappearance of the attributes of the indifferent sexless form. The seeming contradiction is in this manner explained.

The presence of the comb of the rooster, for example, is due to an entirely different cause. It is not a sign of an asexual type, but a real masculine feature, whose development is entirely dependent on the action of specific male hormones. In a castrated hen, the comb does not appear as the feathers do. For the same reason this indication vanishes in the castrated rooster. The action of the masculine hormones was removed and, as a result, the characteristic feature depending on these hormones, disappeared.

The above shows us clearly the origin of the difference between the rooster and the hen, as well as the reason for their similarity after castration, (Ill. 27, 28 and 36).

In reference to Steinach's theory regarding sexual development of the organism, the following obscure fact is brought to light.

We all know that hair almost always appears on the chin and upper lip of elderly women. The voice loses its high pitched character and resembles that of a man. This must be explained by the fact that after menopause, the reproductive part of the sexual gland not only entirely disappears, but the activity of the interno-secretory part which produces the female sexual hormones, is greatly weakened and often completely inactive. This as will soon be shown, causes these characteristics.

Growths, such as those observed in old women, are also noticed in exactly the same places in eunuchs and other castrates. Hence, it naturally follows, that men as well as women derive these qualities from the same asexual origin. In the male the secondary sexual characteristics, under the influence of the masculine hormones are not only distinctly strengthened, but considerably enlarged in the form of a clearly expressed moustache and beard. In the woman, on the contrary, these features under the influence of the female sexual hormones, are entirely suppressed in their development. The observations made on elderly women and eunuchs are now explained. In the latter, in view of the absence of the sexual glands, and their specific hormones, the beard and moustache do not appear. If, however, they have developed before castration, then, as we already know, they will gradually vanish. The only thing that is left is a small growth on the chin and on the corners of the upper lip--the sign of an indifferent asexual condition.

A similar fact is also observed in women. Under the influence of the antagonistic action of the female hormones this feature of the asexual type does not develop. But when after menopause the action of these hormones begins to diminish, and later entirely ceases, this asexual feature reappears.

All these characteristics belong to the general properties of the organism, physically as well as mentally. They all, in one way or another, belong to the asexual form, in which some strongly develop in one sex, being held back in their growth by another and vice versa.

This idea of the development of all our physical and mental features from an originally indifferent form, which only, under the influence of the corresponding hormones takes one or another direction--became a highly satisfactory explanation of an entire series of phenomena in the development of the animal kingdom in general. The limit to which this idea can be applied to the various biological conditions is by no means reached. In the future it is undoubtedly destined to play a greater and more important role.

By Steinach's theory of sexual development of the organism, under the influence of the differentiating reproductive gland, showing its specific action on the asexual body, we can clearly understand the peculiar cases of a sudden appearance of homosexualism in persons, who had been entirely normal before.

We have pointed out above that there is no such occurrence as an absolute differentiation of the sexual gland, but simply a sharp predominance of one sex over the elements of the opposite sex, that the latter do not disappear entirely, but remain in the form of insignificant dormant cells. Thus, every masculine gland carries in itself, dormant characteristics of the female element and vice versa. If, however, for some reason or other, in the recently normal gland these dormant rudimentary cells of the opposite sex suddenly begin to develop, then signs of homosexualism begin to appear, entirely unexpected by the individual. The awakened dormant cells of the opposite sex begin to function and produce the corresponding sexual hormones, which render the brain erotic in the abnormal direction.

Futhermore, as we are all carrying these cells of a gland of the opposite sex, variously developed in each in-

Illustration No. 25.

Section through testicles of male homosexualist.
Testicle of a thirty-six year old homosexualist. SK--seminal canals. MZ--cells of masculine "Gland of Maturity". FZ--cells of the "Feminine Gland of Maturity", recognized by Steinach as specific female elements (F cells).

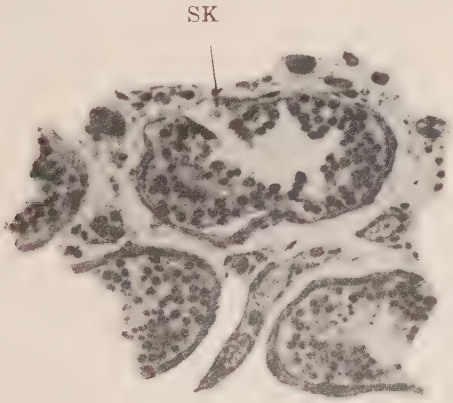


Illustration No. 25.

Section through a testicle of a twenty-three year old homosexualist. (From the collection of Magnus Hirschfield).

(a) Miss Annie Elliott Jones

(b) The eight year old Jadviga with a splendid development of male and female secondary sexual characteristics.

Illustration No. 26.
Bearded women.

(From the collection of the Prussian government institute of sexual biology in Berlin.)

Illustration No. 26.

Bearded Women

(c) Josephine Buda.

(d) Miss Taylor on her 58th year.

(From the collection of the Prussian government institute of sexual biology in Berlin).

Illustration No. 27.

Three year old capon. This bird differs from the normal rooster in the lack of development of the comb. The spurs and feathers of his tail are splendidly developed. (After Castle).

Illustration No. 28.

Castrated hen. As a result of castration there developed splendid male feathers and larger spurs. (Compare with the above illustration. Note the resemblance of the castrated hen with the castrated rooster). (After Goodale).

dividual case, then we are never, so to speak "all man" or "all woman". We belong to a given sex only to the extent of the predominance of one element of the internal secretory mechanism over the other element of the opposite sex. The man is only as masculine, as much of the male elements of this "gland of maturity" predominate over the preserved rudimentary remnants of the female. In the case of women, the reverse holds true. Following these considerations, one could, guided purely by biological principles, place all the people in one long row, according to their degree of "femininity" or "masculinity". Those on the ends would be highly masculine and highly feminine, and all the other men and women would occupy various intermediate places, according to the degree of predominance of either male or female characteristics. All members of this row would strictly correspond to a definite combination of male or female elements in their glands of maturity. We know that such a line was actually produced by Steinach artificially in guinea pigs. This was accomplished by transplanting simultaneously various quantities of male and female glands, whereby he obtained various grades of either male or female secondary sexual characteristics, in strict accordance with the quantity of the transplanted glands. In other words, there was created a graded series of hermaphrodites and homosexualists.

These experiments of Steinach play an important role in the estimate of numerous phenomena of the sexual life in man. They properly explain sexual anomalies. The numerous cases of feminine males and masculine females that we meet in our daily life appear in an entirely different light. These phenomena, which were generally attributed to psychological, social and other conditions have a greater biological foundation, than we have been accustomed to believe. The real nature of the various degrees of femininity and masculinity so often met, must be sought not in places where we wish to see it, but in the hidden small cells, insignificant in size, but powerful

in their actions, of the "gland of maturity". Steinach's tests enable us to approach, from a purely biological standpoint such phenomena of our daily life of whose true nature we had been ignorant. Steinach's views of these anomalies had been expressed long before by a noted naturalist and philosopher, Otto Weininger. Weininger saw in every human being a combination of male or female cells in various proportions. Without tests or definite scientific data, in a purely rational manner he denied the existence of absolute men or absolute women. His conception was expressed in the following:

"In nature there are only an enormous quantity of intermediate degrees of sex between typical man and typical woman. As in physics we speak of ideal gases, following exactly Boyle's law, although in reality there are no such gases in nature, for they all in one quantity or another manifest exceptions to the above law, so here we may speak of an ideal man M. or an ideal woman F. who in reality do not exist, but who make up these two opposite poles, between which are situated all the possible intermediate forms".

"The question is", continues Weininger, not about the normal bisexuality, which we comparatively rarely meet (hermaphroditism and homosexualism), but about the every day bisexualism inherent in every human being.

The "man and woman represent two origins, which in all individuals are mixed in different proportions. There is not found in nature an absolute man or an absolute woman, but organisms that are in a greater or lesser degree masculine or feminine". Weininger formulates his views as follows. "If, we denote the elements of masculine origin by M. and the elements of feminine origin by F then every male (A) would be represented by a predominance of M elements plus a few F elements, and every female (B) would represent a predominance of F elements plus a few M elements.

If M, is considerably greater than F, that is, if in the organism the M elements sharply predominate over

the F elements, then before us is a clearly expressed male. If, the F elements in the organism predominate over the M elements, then the result is a female. However, when in the male the quantity of F elements, is increased and the M elements diminished, then the predominance of M, over F, becomes insignificant and the result is a feminine male. On the contrary, when there is an increase of quantity of male elements in the female and the F elements are diminished, then the result is a masculine female.

And lastly, if the quantity of male and female elements in the organism are approximately the same, the result is either a hermaphrodite or homosexualist."

Absolute man and absolute woman, according to Weininger, do not exist in nature. They are only an idea. These ingenious suppositions of Weininger found a splendid confirmation in Steinach's experiments.

CHAPTER VII

THE PROBLEM OF OLD AGE AND THE ATTEMPT OF ITS SOLUTION BY STEINACH

We are approaching the next stage in the development of Steinach's works, the famous experiments of artificial rejuvenation and the prolongation of human life. All his previous achievements, as we shall soon see, forms a foundation, on which his later work could be built. The boldness of the plan, and the splendid aim of this work considerably surpasses everything which Steinach had done up to that time. Thousand of years has the problem of life and death continued to be the object of scientific investigation. For the philosophers it has been the foundation of their systems and it has served authors as a plot for numerous literary productions. For ages the human mind has been working on this insolvable riddle. An endless number of theories of life and death, an enormous accumulation of hypothesis about the origin and nature of old age, appeared as the result of these long labors and tireless investigations. In one form or another, they all answer only some small part of the question, leaving the rest of it in darkness. At first the investigator was interested in the question of the normal duration of human life. Undoubtedly, the period of life allotted to human beings by the psalm-singers, between 70 and 80 years, is pretty near reality. Exact statistical data at the present time confirms the correctness of the figure. The duration of human life apparently was at all times the same. Regarding the exceptional old ages reached by the biblical patriarchs, there must have been a different method of chronology. Individual cases are extremely rare as they have been in all probability even in the biblical times. Otherwise, they would not have been mentioned. Therefore,

it seems unjust that man, who possesses such a highly spiritual development should be given a comparatively short life by nature. This injustice to man seems even greater, when we consider the fact that many forms of animals, who stand on a considerably lower plane of development, possess a greater duration of life. The longevity of the latter is in general extremely varied, and it is quite difficult to find a relation between the life of one animal and that of another. For an explanation, we shall quote the longevity of various animals. Thus for instance, in the mammalians it varies to a great extent. In general the smaller animals of the latter possess a comparatively short life, although this does not always hold true. For example:

Rat	2-2½ years.	Fox	12 years.
Mouse	5-6 "	Sheep	12-14 "
Rabbits	5-7 "	Goat	12-14 "
Guinea Pig	8 "	Wolf	12-14 "
Hare	8-9 "	Wild Goat	12-15 "
Cat	9-10 "	Dog	15-18 "
Squirrel	10-12 "	Pig	20 "

The bigger mammalians live:

Horse	30-35 years.	Man	60-80 years.
Horned animals	25-30 "	Gorilla	60-80 "
Bear	35-40 "	Camel	80-90 "
Donkey	40-45 "	Elephant	150-180 "
Lion	40-50 "	Whale	170-200 "
Mule	50-60 "		

If among the mammalians, we find with difficulty some relation between the size of the animal and its longevity, then this is entirely absent among the birds. The latter live:

Sparrow	5-6 years.	Indian Rooster	16 years.
Swallow	6-7 "	Pheasant	25 "
Nightingale	8-9 "	Eagle	90-100"
Pigeon	10 "	Crow	150 "
Canary	10-12 "	Swan	150-200"
Hen	10-14 "		

In this manner, among the birds, the longevity corresponds still less to the size of the animal. Among other classes of animals, amphibians, reptiles and fish, the duration of life is:

Frog..... 6-7 years.	Turtles..... 200 years.
Toad..... 30-40 "	Crocodile.... 150-200"

A full sized large turtle now in the London Zoological garden was caught in 1783. It is estimated that the turtle is about 300 years old.

Carp ..... 120 years.

Gessler caught a pike in 1923, whose age was estimated at 267 years old.

Certain forms of pike.....300 years and more.

Here also, we find the inconsistency of the relation between the size of the animal and its longevity. This inconsistency however, is still greater, if we compare the individual representatives of various classes of animals, like the duration of life of an enormous lion and a carp or pike, or the duration of life of a man and a turtle.

Extremely interesting is the ratio between size and longevity among the insects. Their length of life varies extremely, even in the very same form, depending on the sex of the animal. Thus, for instance among the ants, the males live only two or three months; the females on the other hand, reach an age of five and six years. Among the bees the duration of life of the males is also measured by a few months. At the same time the queen lives two to three years and even longer. The varying length of life among insects, depending whether they belong to one or another, is, from the biological standpoint, extremely important and many are ready to see in this the key to the solution of the whole problem. This explanation was brought about by the following facts: among some insects the male perishes immediately after the impregnation of the female, either as a result of a sudden enfeebleness, or like the spiders, he is eaten up by the female right after the act of copulation.

It is clear that a perpetuation of species among different animals varies a great deal and depends upon a whole series of internal factors and surrounding conditions. Thus, for example, those animals that lead a life of polygamy, and in this manner easily and frequently multiply, find no need in a long individual life for the preservation of the species. On the other hand, those varieties of animals leading a life of monogamy multiply very feebly and rarely, and are, therefore, in need of a longer life, for otherwise, the chief purpose, that is, the preservation of its kind, would not be sufficiently secured. The above may be explained by the following example: The eagle lives a monogamal life, hatches one or two eggs and reaches maturity about the age of ten. The hen as we know, leads a polygamous life, hatches fifteen to twenty chicks at a time, which in turn may reach maturity in the very same year and multiply themselves. It is clear then, that in the case of the eagle, the perpetuation of the species is less secure than in the case of the hen. Therefore, the eagle should possess a longer life, to be able to produce and bring up a posterity. Among the hens this is easily reached during a comparatively short time and, therefore, their life is considerably shorter. These views are confirmed by the following data. Let us consider the multiplication of 20 eagles and 20 chickens. A simple mathematical calculation will show that after ten years of breeding the former (consisting of ten pair) under the best of circumstances will produce a generation of two hundred and twenty eagles. The same number of chickens (consisting of 18 hens and 2 roosters) multiplying uninterruptingly would produce after one year 300 birds; after 3 years 60,000 after 5 years more than ten million and after ten years about 5 billion—what a colossal difference there is in the degree of perpetuation of the species? Even in one year of development as the figures show above, the chickens produce a greater generation and that means a better preservation of its kind—than the same number of eagles in ten years. Consequently, the latter

are in need of a longer life than the chickens for the continuation of their species. If we now approach with this criterion the longevity of other animals, we can note everywhere the same reversely proportional relation between the rapidity of reproduction and the length of life. If we apply this reasoning to man, considering the fact that at the age of 45 to 50 his ability to multiply ceases and that he requires 15 to 20 years, for the bringing up of his posterity, we obtain an age of 60-70 years, which according to this theory, would be the normal duration of human life. We know that in reality these calculations are justified. From this standpoint it becomes clear why the elephant which multiplies very slowly lives more than a hundred years, while the rat for example, which gives birth several times during the year and brings into the world a large family, lives only two or three years.

Thus the above conditions for the preservation of the species, play in this problem, according to this theory, a deciding role. If among insects the male frequently perishes soon after the impregnation of the female, it is because he is no longer required for the coming generation. After his part is played, he may go. Everything for the species and nothing for the individual—this is the motto put forward by nature, according to Schopenhauer.

We must admit, that although the quoted theory has its weak points, and may not be able to answer all the arising questions, nevertheless, the fact remains that there is a very close relation between the length of life of the various animals, and their function of propagation. This incontestible idea is full of numerous deductions.

It must be stated, that on the basis of the above mentioned theory rests the possibility of the prolongation of life among the various animals. From the standpoint of this theory the longevity of the animals does not depend on one or another structural peculiarity in their organism, but is in the closest relation with the entire past of the species, to which the given animal belongs. Its existence depends on conditions worked out during thousands of

years. In other words, the duration of life has its roots in the history of the given species, in its entire evolution. Therefore, to change voluntarily this normal continuation of life seemed not only difficult but entirely impossible.

Nevertheless, there are in science numerous conditions, which may be explained in various ways. Exactly this happened with the above mentioned facts. They undoubtedly prove the closest relation between the duration of life and the function of propagation, and one may make from this just the reverse deductions. Namely, in this relation one can see the origin of a successful, practical solution to the problem. One can see the direction of the road, which may lead to the consecrated goal.

This road, as we shall show later, was chosen by Prof. Steinach independently of the above mentioned deductions. It would be a mistake to suppose that human thought was satisfied with this reasoning and did not aspire to correct the unjust natural defect of our limited longevity. Numerous means were offered for the prolongation of our life. All possible elixirs, various collections of grasses, numerous forms of diets, rejuvenating sorcerous drinks, everything was tried in the struggle with the ancient evil—premature old age and death. However, as one investigator justly remarked, even now we know of too many means for the shortening of human life, but not one to prolong it! All the resources against old age offered at various times, have really secured, according to Steinach, a very pleasant and prolonged old age and a still greater capital, but only for the inventors. Humanity, on the other hand, did not become any younger or—wiser.

As to the scientific investigations undertaken in this direction it may be said that an enormous number of theories and aphorisms were created, each one more beautiful and more ingenious than the other. But all these not finding any confirmation in reality, and a still less practical application, were soon changed by others, which were in turn destined to the same fate. All the

theories have this much in common, that their authors usually picked from the general picture, one peculiarity of old age, which particularly attracted their attention, and considered it as a cause of all the other complications of senility.

Thus, some paying particular attention to the changes in the blood vessels, a condition known as arterio-sclerosis, which usually accompanies old age, laconically express themselves that the organism is as old as the arteries. Others have considered the following fact: The quantity of water in the organism during the individuals life gradually diminishes. During the very early embryonic stage, the organism contains 90 percent of water and only 10 percent of solids. At advanced age the water contents of the organism is only 50 percent and the other 50 percent consists of solids. As a result of the gradual diminution of fluids in the organism, and the increase of solids, the investigators considered this apparent solidification of the tissues as the real cause of old age. Nevertheless, it is not difficult to see, that the authors of these hypothesis regretably and constantly confuse consequences with causes. It is clear that the changes in the walls in the blood vessels as well as the decrease of fluids in the organism are not causes of old age, but only the consequences thereof.

Of a similar character were all the other ideas advanced by various investigators for the explanations of senile changes in the organism. A great variety of opinions arose to answer the question, regarding conditions under which the alterations of old age took place in the organism. What factors in our daily life would cause either the hardening of the arteries, or the tissues, or any other feature accompanying senility? Here the likes and dislikes of the authors of the various theories were still more outspoken.

Thus, some wished to see the main source of senile suffering and untimely death in the excessive use of alcoholic

beverages, as a cause of premature arterio-sclerosis.* This group of authors considered total abstainence a positive means for the prolongation of human life. Others, (namely, the "antiprohibitionists") expressed a contrary opinion, and even supported it with scientific data, that one of the greatest factors that has an important influence on the vital processes of the human organism is the spiritual condition. Alcoholic beverages, removing all the human care, and returning to the individual a feeling of well being, should act beneficially on the prolongation of life. The partisans of both theories quoted examples from life, for the support of their views. While some refer to persons of a particularly long life, who were strict abstainers, the others on the contrary, showed example of noted drinkers, who reached an advanced old age. Thus they pointed to the surgeon Politman, who attained an age of 140 years, retaining up to his very end a full working capacity. On the very eve of his death he operated on his wife, who was suffering from cancer. It is related about the phenomenal old man, that from the age of 25 he had not spent a day in a sober condition.

The same is told about an Irishman named Brown, who lived 120 years. His last wish was to inscribe on his monument, that he was always drunk and that his intoxicated condition was so terrible that even death itself was afraid of him.

Some turned their attention to the fact, that the majority of people, who reached advanced age were married, occasionally even several times. Thus, for example, it is related about a certain Frenchman, who has reached an age of 110 years, that at 99 he married for the tenth time, and at the age of 101 he became a father. And so the antagonists, or rather the women, antagonistic to the single blessedness of men, wished to see in this case another proof, that marriage is one of the surest means for the prolongation of human life.

*As a matter of fact arterio-sclerosis is the rarest complication found in chronic alcoholics. Translator.

On the contrary, convinced bachelors deducted from this case an entirely different conclusion. If a man, they said, as it happened with the above mentioned Frenchman, has reached old age in spite of ten marriages, then it simply proves that there are still in nature truly undestructive organisms, which even ten wives could not overcome. For other husbands a considerably smaller number would have been sufficient. The supporters of this latter view pointed out favorable cases in which bachelors have reached a very old age. (Kant, Schopenhauer).

Who is right then? To a certain extent both. It is beyond doubt, that a more balanced, sexually restrained life in marriage with all its domestic happiness, may to a considerable degree have a beneficial influence on the general condition of the organism, and consequently promote a longer life. On the other hand, it is true that if an organism, like the one mentioned above is so naturally vital and active, that his sexual glands at the age of 100 are still productive and capable of bringing about a posterity, such an organism should naturally be recognized, as phenomenally indestructive.

Where then is the solution? Undoubtedly, all the above mentioned facts play just a secondary role. In all the cases of exceptional long life, an extremely important factor was not considered, the most important in the development of life in general. This factor is--heredity. Longevity belongs to this category of vital properties of the organism, which are quite frequently hereditary. Instances of long aged families are well known to everybody. But what does this factor consist of? What is the mechanism of this hereditary old age? On this question we can not even now give any satisfactory explanation. Neither by microscopic examinations, nor by the most delicate physico-chemical investigations could we discover this mysterious mechanism. However, the existence of heredity itself as a factor, and its enormous influence in the above mentioned cases, is beyond any question.

Furthermore, the spiritual life of man plays an important role. It is a well known fact, that scientists and especially mathematicians, philosophers, astronomers, live very long (Newton, Kant Schopenhauer). Here the powerful development of mental processes in connection with typical spiritual calmness and deep internal satisfaction, which is a result of the creative mind, shows a colossal influence on the body and is a very important factor in the prolongation of life. Only from this standpoint can one explain the peculiar fact why many philosophers with an extremely weak, sickly, physical organization, like the famous Kant, have reached an advanced age. In connection with the above the following observations appear extremely interesting. People whose daily activity demands comparatively greater mental or spiritual exertions, will feel themselves capable, young and energetic throughout their life. But in case of a sudden cessation of their activities, they betray a rapid loss of strength and soon die This is noted repeatedly. Apparently, in some cases, mental exertion acts as a powerful stimulant, supporting the vital functions on a definite high plane.

If the activity of these people, demanding for a long period of time considerable mental exertion, should suddenly cease, then the above mentioned stimulants of all the vital processes of the organisms are simultaneously terminated. The result is a sharp, lowering of these processes, ending in death. It may be considered as a sort of a spiritual shock leading to physical destruction. That is why people, who have been accustomed to devote a considerable amount of their time to mental work should not suddenly stop their activities. A man doing for the most part physical work, does not depend upon this mental factor. However, people whose daily routine demands mental exertion, easily become the prey of old age and die, if this higher stimulant is suddenly lost. Mental work is not only necessary, but it is of the highest importance to avoid fatal consequences of old age. This does not shorten life, as is generally supposed, but, on the contrary, prolongs it

considerably.

Finally, we shall mention certain theories, directed towards solution of the problem in a certain mode of life or in a diet. Here is clearly shown the influence of the likes and dislikes of the originators of the theories. Some have proved that the most reliable means for the prolongation of life is a strict vegetarian diet. Others on the contrary, maintain that meat is the most nourishing substance for the organism. Some agitate strict abstainence from alcohol--others--from tobacco. A third group from dainty foods. Some were trying to devote themselves to sports; others were wearing certain underwear; still others could see a benefit in light reading, etc., etc., etc. We could quote hundreds of such theories and means for the prolongation of human life. And it is beyond doubt that they all were beneficial for the simple reason that their supporters had a very deep faith in their actions. This very faith, this fact of auto-suggestion, which plays in these instances such an important role shows a beneficial influence, not only on the mental condition of man, but on the course of all the physical processes of the organism. In this manner they become a definite factor for the prolongation of life. Nevertheless, these theories could not hold out for any length of time. After playing their part in the transitory scientific fashion, they soon finished their course and were replaced by other more fashionable ideas.

We may finally see that of all the promoters, who tried to enlighten the obscure phenomena of senility, Steinach is the only one, who boldly put forward this problem. Namely, to combat the normal process of old age, to reverse the wheel of development of the organism and produce a rejuvenation in the already aged body. Steinach does not only aim to prolong human life, but to return to people their lost youth.

CHAPTER VIII

THE FIRST OF STEINACH'S EXPERIMENTS WITH THE REJUVENATION OF ANIMALS.

We have acquainted ourselves with the path, which Steinach followed to solve the question he placed before himself in 1894, concerning the influence of the sexual glands on the organs of animals. We have seen how his work developed step by step. What a logical sequence of tests! Each one hiding in itself the origin of the one to come. The results of all these experiments were a complete explanation of the interno-secretory activity of the sexual glands and the role they play in the life of the organism. According to Steinach this question was not fully exhausted. He decided to approach it from another previously unrevealed side. It seemed interesting to him to follow the path of the sexual gland during the entire period of the individual life of the animal, not only from the qualitative point of view, but also from the quantitative. We have shown before that in his tests of transplantation of sexual glands into young castrates, Steinach could establish an extremely interesting and important proportional relation between the development of the transferred gland of maturity, and the appearance of the corresponding secondary sexual characteristics in the operated animal. Transplanting into the castrates only small quantities of the gland, Steinach obtained a correspondingly partial appearance of the secondary sexual features so that the operated animals occupied only an intermediate place between the castrate and the typical male. The same result was obtained, when an entire gland was transplanted but failed to take root, and in this manner only partially exercised its activity. In this case, as

we have already seen, the degree of the development of the secondary sexual characteristics of the male always strictly corresponded to the quantity of transplanted and growing glands. Steinach succeeded in a purely experimental way in creating an entire series of animals, expressing in various degrees the secondary sexual characteristics, beginning with the typical castrate and finishing with the ideal male, well developed in the sexual sense. We further know that in those cases where the transplanted gland of maturity has developed particularly well in its new place, and the secondary sexual features, both physical and psychical, appeared with a particular vigor, the operated castrates have not only reached the development of the normal males, but even surpassed them in a considerable degree. We may say that the castrates in these cases, were "hypermasculinized". Similar results Steinach obtained in castrated females by the transplantation of ovaries; here also he found a strict relation between the development and function of the gland of maturity on one hand, and the appearance of the secondary sexual characteristics on the other.

With unusual scientific ability Steinach has proven by his experiments the significance of the quantitative principle in the function of the sexual gland in still another way. After reaching a "hypermasculinization" or "hyperfeminization" of his castrates, Steinach began gradually to remove parts of the transplanted gland. And according to the degree of removal, the secondary sexual characteristics gradually diminished. These mathematical relations between the quantity of the "sexual gland of maturity" and the degree of development of the corresponding sexual features, are of unusual importance in the estimation of all the results obtained by Steinach. For him personally, they played another highly significant role.

Following this quantitative relation on one hand and the fact, that the splendid activity of the sexual glands in youth corresponds to the magnificent bloom of all the sec-

Illustration No. 29.

An old male rat before rejuvenation. (After Steinach.)

Illustration No. 30.

The same rat after the operation for rejuvenation. (After Steinach).

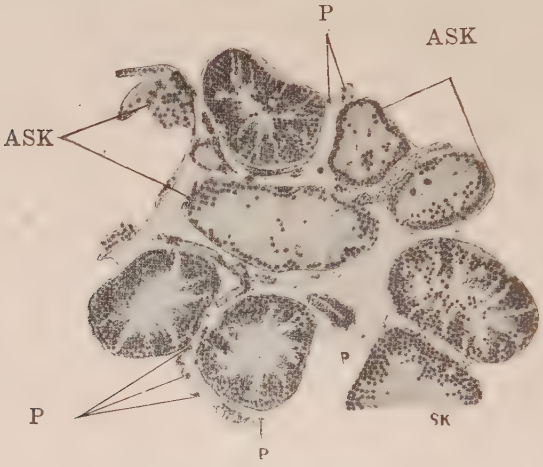
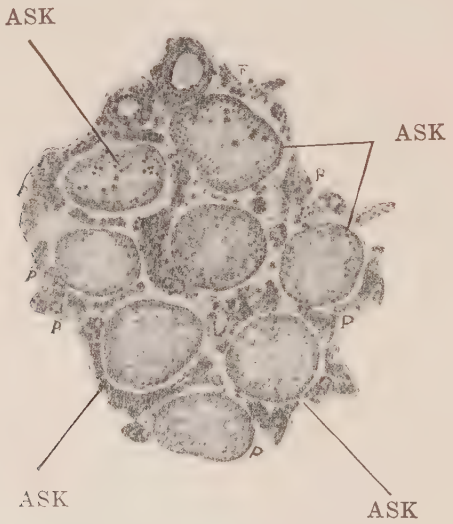


Illustration No. 31.

Section of testicle of an old male rat. SK and ASK--Seminal canals. P--hardly noticeable, Leydigs cells (After Steinach).



Testicle of a rejuvenated male rat five weeks after operation. The seminal canals (ASK) have suffered a retrograde degeneration. But the interstitial gland (P) has powerfully developed. (After Steinach).

ondary sexual features of the organism; that a gradual loss of activity of this gland towards old age corresponds to the weakening of these characteristics, Steinach asked himself the question, "Are not these relations analogical to those which were established in the quantitative experiments? In cases of youth, does not the development of the secondary sexual features also correspond with the same mathematical exactness to the increased functions of the gland of maturity? Is not the weakening of these features towards old age a result of the decrease of quantity of hormones entering the blood? And if this is so, Steinach thought, if the internal relation and the mathematical correctness are the same, is it not possible to stop artificially the disappearance of the secondary sexual characteristics, those typical attributes of youth? Is it not possible by means of transplanting a younger "gland of maturity' into the old organism to restore the disappearing features of youth? Why not reverse the normal flow of vital processes in the opposite direction? Is the fascinating problem of artificial rejuvenation really insolvable? This last of Steinach's problems is a result of all of his previous investigations.

It is necessary to point out, that in favor of Steinach's suppositions was a whole series of observations made both by Steinach and by other investigators. Among the castrates as a result of the removal of the sexual glands, there appear a series of changes in the organism which fully remind one of alteration occurring at old age. On one hand, a series of purely external signs appear among old men as well as in castrates, such as: a considerable weakening of growth of hair (old men shave less frequently than young men), wrinkles on the face, a weakening in the changes of the vital process of the organism, the loss of sexual function, etc. On the other hand, the investigation of numerous internal organs and most important glands such as the thyroid, pituitary, etc., discloses among the castrates characteristic senile changes. Finally in their psychical sphere, there was observed among the

castrates a series of deeper manifestations characterizing, as a rule, old age: a considerable suppression of mental activity, bad memory, a sharp lowering of energy and initiative, and equally well an entire series of other peculiarities both in character and temperament.

Taking into consideration the above reasoning and supported on the results of his previous experiments, as early as 1910 Steinach advocated boldly the problem of artificial rejuvenation by means of regenerating the hormone producing activity by the sexual gland. Two years later, (Dec. 5, 1912), at a conference of the Academy of Science in Vienna, he could announce the solution of this problem in a very definite manner.

Steinach acknowledges that he intentionally did not hurry with the publication of his works. First, because he wished to verify the results he had obtained on a greater number of animals. Second, because a premature acquaintance of society with the experiments of rejuvenation, could in Steinach's opinion, result in a series of dangerous tendencies, and consequent bitter disappointments. Now, however,when the conception of the function of the sexual glands, and the role of the sexual hormones is almost general property, and reports are being read in various places about the above mentioned subject, and when finally the experiments themselves have been verified on a larger scale, and are now practiced on human beings, Steinach offers to contemporary science his solution of the old problem of artificial rejuvenation and the prolongation of human life.

What then is the nature of Steinach's last attainments?

The duration of life of rats, to whom he is greatly indebted for his scientific success, is considered from 27 to 30 months, an age of more than 30 months is a rarity. The signs of old age appear among rats between 18 and 23 months and express themselves in the following manner: the hair on various parts of the body begin to fall out, the eyes become turbid, the posture is stooping, the animal loses in weight considerably. The same sharp changes

take place also in the internal organs, especially in the sexual. The testicles shrink, and other parts of the sexual apparatus suffer a retrograde degeneration. Microscopic examination of the sexual glands disclose a degeneration, not only of the seminal canals, but also a considerable decrease in the number of interstitial cells, that is, the gland of maturity.

Similar changes are noticed in the behaviour of the older animals.

The young animal is wiry and lively. Placed in new surroundings, he shows great curiosity, tries everything, touches everything. If another male is brought into the same cage, the first will immediately enter into a fight, frequently for life and death. When a female is brought in, he is tireless in playing with her. He washes and cleans himself often.

Quite different is the old male. He is motionless, indifferent, does not seem to enter into fights with a male brought into the same cage. If the antagonist forces him into combat, the old male defends himself feebly, and soon retreats entirely, taking up his usual motionless position. He is indifferent to everything, even to the female. He spends most of his time in sleep, eats very little and rapidly loses weight. His respiration becomes difficult. The work of the heart is slower. The animal shows a complete apathy to the various external influence, stops washing and cleaning himself even when covered with lice. Particularly striking at first glance is the difference in the posture of the young and the old animals, and the difference in their general appearance. The young animal sits straight head up, eyes clear, expressive and disturbed. The old rat sits bent up, head is lowered, the eyes turbid, motionless, without any expression. Steinach justly remarked that the difference in behavior between the old and the young animals is beyond description, so that even the photograph cannot transmit all the distinctions, which must be either personally observed or taken by a moving picture. On old rats, such as those describ-

ed above, Steinach began his experiments of artificial rejuvenation. From the data of his previous experiments with the transferred glands, Steinach could conclude even earlier, that in his experiments of artificial rejuvenation, he should employ the method of transplantation. In these first experiments, Steinach transplanted into the abdominal muscles of old rats the sexual gland of a three month old male. If the transferred gland or even one of them took root, then three weeks after the operation, one could already notice the beneficial action of the transplant. The condition of the organism was improved beyond recognition. The operated animal began to manifest all the indications of youth, such as: liveliness, curiosity, sexual impulse, a desire to fight with males, etc. The apparently extinguished functions came back to life. The entire behavior and mentality of the animal totally changed and manifested a strong influence of the transplant over the entire organism of the operated rat.

It is important to note that a similar method of rejuvenation of the decrepit organism was performed by the Biologist Harms, in 1914, six years before the publication of Steinach's work. The former removed from an old male guinea pig, betraying the signs of senile impotence, half of his testicle and transplanted into its place one of a male six weeks old. At the end of one week, the results of the operation was very pronounced; there appeared a strong sexual tendency, the animal began to pursue the females even outside of the usual rutting period, and attempted to possess them. The secreted semen contained living spermatozoa. After a short time, the operation of the transfer was undertaken on the second testicle with the same success. This condition of rejuvenation attained by Harms on the guinea pig, did not last long—only about four weeks. The cause of this must be looked for in the imperfect technique employed by Harms. Apparently he did not obtain a real and definite growth as has taken place in Steinach's experiments, who has transferred the sexual glands, not into the testicles,

but into the abdominal muscles and then with the greatest technical care.

Nevertheless, Steinach is ready to recognize this test of Harms as a real, although short lived, rejuvenation.

More pronounced are the results of transplantation among the females. The signs of old age among the latter generally coincide with those of the males. Absence of appetite, complete immobility, indifferent behavior towards the surroundings and extreme uncleanliness completes the picture.

In regards to sexual relations the changes are not less pronounced. The ovaries are shrunken, the uterus diminished in its circumference, the nipples are hardly noticeable. The animal loses its ability of reproduction.

Very characteristic is the relation of young males to these old females. If a young female is brought into the cage of a young male, he becomes extremely excited. He soon begins to pursue her and play with her, and in spite of the resistence she offers, he makes attempts to possess her. The young female in this manner has a strongly exciting influence. Entirely different is the relation to the old female. The young male at the first meeting betrays a certain curiosity, which is generally characteristic of rats. But notwithstanding his sexual hunger, he is very soon calmed and leaves her alone. The old female has lost her exciting attractions. Just into these old decrepit females, Steinach transferred the ovaries of the young rats. The results of the operation were astounding. In almost every case he has obtained a complete rejuvenation. For the transplantation, Steinach employed the ovaries of the recently impregnated four month old females. In such ovaries, the "gland of maturity" discloses a particularly powerfully development, and therefore, according to the theory, the results of the operation should be more pronounced.

The first experiments Steinach performed on an old rat 26 months old, which had not been pregnant for the past ten months. The animal was repeatedly placed during

the last four months into the cage of young males, but did not seem to have any exciting influence over them. The external appearance of the animal showed a series of characteristic senile changes. The skin became poor, with numerous bald places all over the body, the nipples hardly noticeable, general appearance, posture, expression of the eyes, typically old. At the same time observation showed a series of other signs, both physical and psychical.

But, very soon after the operation there appeared marked changes in the entire constitution and behaviour of the operated rat. The animal ate better, washed and cleaned itself. The seemingly signs of senility gradually disappeared. The animal again began to exert a strong exciting influence over the young male. After a short while, for the first time after a ten month interruption, the rutting period followed. The nipples had considerably increased in size and gave the impression of an entirely young female. The young males on meeting continually pursued her, and quite often seized her without any resistance on her part. About three months after the operation, the animal became pregnant and built her nest. On the 23rd day of pregnancy, the rejuvenated rat brought into the world a family of five. Having reached an age of 29 months, the operated rat in this manner after a year of sterility, gave birth again. The rejuvenated old mother produced an abundant supply of milk and her babies were abundantly fed. The latter were very well developed. The condition of rejuvenation, as well as the exciting action of the rejuvenated old rat over the young males continued for ten months. After 10½ months, following an operation the female died, reaching in this manner an age of 36 months, which is very unusual among rats.

The investigation of the transplanted glands in the rejuvenated males disclose a splendid development of the "gland of maturity." The beneficial action of the operation on the general condition of the organism thus receiv-

ed an explanation in accordance with the theory. Unexplainable only seems the fact of fertility observed in the operated rat, which had been sterile for almost an entire year. It is clear, that the transplanted and growing ovaries surrounded by connective tissue on all sides, were entirely separated from the (uterus). Consequently, the ova, if such could mature in the ovaries could not have reached the necessary place. The only explanation that can be given to this peculiar appearance is that the hormones of the transplanted gland exerted a strong regenerative influence on the long extinguished ovaries of the operated rat. The latter, stimulated and revived, became active both in their interno-secretory parts, as well as in their reproductive function.* The ova produced by the ovaries of the rejuvenated animal were then impregnated. In this manner the action of the operation on the organism of the rejuvenated rat must be distinguished in the form of two stages, one following another. Namely, in the first stage, the transplanted ovaries manifest their activity. Later, under their influence, the glands of the animal itself are regenerated to a new activity, acquiring again, the almost extinguished ability of forming reproductive cells. Investigation of the ovaries of the rejuvenated rat confirmed the correctness of this explanation given by Steinach in full accord with the above mentioned suppositions. The ovaries of the rejuvenated rat have been found to be again in a condition of vital activity and capable of reproduction. It was shown that a regeneration of the interno-secretory part of the gland took place and the reproductive part forming the ova, was fully active and did not disclose any signs of degeneration.

Thus, in the entire process of rejuvenation, a very great if not the main role belongs the glands of the animal itself, called forth to a new life. The transplanted glands play only the part of a remedy which brings about the

*Clinical experience seems to justify this view.

Translator.

regeneration of activities of the glands of the animal itself. This fact, as we shall show later, plays an important role in all the ensuing works of Steinach.

Reviewing the data of the first of Steinach's experiments on rejuvenation, we can see that the transplantation of young sexual glands into old rats, male as well as females, had revived in the operated animals their lost youth, and made it possible for them to breed after a long interruption. The problem of rejuvenation was in principle, almost solved by these experiments. But Steinach did not consider himself fully satisfied with the result of his works. The reasons can be readily seen. Previously, in our discussion of the treatment of homosexualism by means of transplanting the glands, we pointed out the fact that this operative means of treatment of the clearly psychical phenomenon (abnormal sexual tendencies), having no comparison in the history of scientific thought, both as to its beauty and its ingenuity, has in reality met with considerable difficulty. The latter, as it was already pointed out, consists of the fact that the surgeon cannot always and everywhere find the necessary material for the transplantation. The same practical difficulties must be considered when we are discussing artificial rejuvenation. Also in this case, only rarely and quite accidently can the surgeon find young healthy sexual glands for transplantation into old men. On the other hand the difficulty to find enough people, especially women, who would voluntarily sacrifice this unusually valuable material, can hardly be conceived.

Here, Steinach took up the last question that crowned the entire chain of his ingenious thoughts; is it not possible to employ some other means, except transplantation, for the regeneration of the activity of the sexual glands of the decrepit animal in order to avoid the necessity of employing outside material?

CHAPTER IX

THE FURTHER DEVELOPMENT OF STEINACH'S EXPERIMENTS ON REJUVENATION AND THE FIRST TESTS ON HUMAN BEINGS.

In the previous chapters the results obtained by the transplantation of the young sexual glands in old rats have been discussed. The immediate influence of the new gland on the organism of the operated animal; and the action of the transplants on the glands of the animal itself. The latter, under the influence of the secretion of the transplanted gland were revived to a new activity, and of their own accord, showed a powerful influence on the general condition of the organism, regenerating the lost ability of reproduction. Consequently, as has already been pointed out, the chief role of the effects following the operation, must be attributed to those glands. Therefore, Steinach thought, the entire question comes to this: to call forth to a new life the sexual glands of the old animal itself. Finding the means, whether surgical, physical or chemical, which should immediately cause in the old animal an increase of function of the interstitial tissue, without transplantation, would solve the problem. Then employing the increased strength of the organism, it would be possible to obtain those results of rejuvenation, brought about by the transplantation of young sexual glands. Steinach also recognized the possible economy of the strength of the organism. For the purpose of rejuvenation of the organism, according to Steinach, it is necessary first to make use of the strength of the senile glands, regardless of the technical difficulties involved. And only after the strength of these glands are exhausted and the operation for rejuvenation produces no im-

provement, should one have recourse to the transplantation of young glands. Steinach also succeeded in finding a few other methods of rejuvenation, which could take the place of transplantation.

X-rays, for example, given in careful, exactly regulated doses exert an exciting action on the growth and development of the interno-secretory elements of the sexual glands. By this means, Steinach and his co-workers succeeded in producing a powerful development of the "gland of maturity", in the ovaries of virgin guinea pigs, and also, an increased development of all the secondary sexual characteristics to an extent resembling a pregnant animal (considerable increase of the uterus and strong development of the breasts).

Furthermore, by the introduction into the organism of an entire series of chemical substances, like iodine, for instance, he also succeeded in producing the development of the interstitial tissue that is, the interno-secretory part of the sexual gland. But the most practical procedure considered by Steinach in regard to rejuvenation of male subjects, appears to be the ligation of the outlet of the sexual gland. (vas deferens).

The sexual glands in reality consist of two parts entirely independent of one another. One is the reproductive, the typical gland with an external secretion, having an outlet (the seminiferous tubules in the male and the ovaducts in the female), through which the product of external secretion, the reproductive cells, reach the surface. The other is an interno-secretory gland, what Steinach calls the "gland of maturity", contributing directly to the blood specific sexual hormones. Steinach tied off the outlet of the reproductive gland which produces the semen, with the object of rejuvenating the individual. By this method, he does not touch the interno-secretory parts of the glands producing the hormones.

How, then, as a result of this operation is the interno-secretory gland called forth to a new activity?

The fact is that under the influence of the tied outlet

of the testicle, the semen is not produced, or, to be more correct, the produced semen does not have the proper outlet, and remains in the gland. As a result of this stagnation, the seminal gland, as usually happens in such cases, undergoes a retrograde degeneration, becomes considerably smaller, creating room for the interstitial internosecretory tissue , known as Leydig's cells. Those cells, up to that time, crowded and retarded in their growth by the well developed seminiferous tubules which occupy considerable space. Soon after the degeneration of the latter the interstitial tissue suddenly receives a greater extension and full freedom of development. In this manner the retrograde degeneration of the seminal gland allows as a consequence, the development of the "gland of maturity". The same thing takes place here, as in the transplants. The seminal part perishes, and the internosecretory element develops powerfully. This particular development of the interstitial tissue of the tied off testicle causes the changes which take place in the organism under the influence of the operation.

It is obvious, that such an animal with the outlets of both testicles tied, is destined to inevitable sterility. But the general condition of the organs is greatly improved. However, if we should tie off the outlet of only one gland and let the other continue to function normally, then under the influence of the former, the second, which was not operated on, will be called forth to a new life and will produce semen. The animal which has been for many months impotent up to the time of operation, again becomes able to reproduce itself and bring a strong and healthy breed. Here takes place the same thing that occurred in Steinach's experiments with the transplantation of testicles into the old males. In these cases the transported glands called forth to a new life the decrepit glands of the aged animal, that were inactive for a comparatively long period of time. These soon acquired the ability of reproduction.

In this manner the operated animal is rejuvenated, not

only in the general condition of the organs, but also in its reproductive ability.

The operation itself is performed by Steinach in such a manner that the outlet of the testicle is tied off immediately after it leaves the gland. The operation presents the technical difficulty of ligating the outlet itself, and not including in the knot the neighboring nerves and blood-vessels, which nourish the testicle. Otherwise, the gland, deprived of its nourishing innervation will soon die. Then the operation is a failure, and may be followed by a whole series of physical and mental disturbances. This drawback is of important significance and we shall return to it in our critical review of Steinach's works.

Now, we shall consider those changes which take place in the organisms of the operated animals.

Steinach operated on a male rat—27 months old, who had showed complete impotence and loss of every interest, even the desire of the female. For a long period of time senile changes were expressed in a very pronounced degree. The entire skin was covered with bald places, the animal had greatly lost in weight for the previous few months, and disclosed an extreme decrepitude. Its posture remained unchanged in a bent position, the head lowered, its eyes turbid, without any expression. The animal showed a complete apathy to its surroundings and even avoided fights with other animals. When compelled to do so by an antagonist, the old rat defended itself feebly and soon retreated, taking its former position.

In this animal, marked by such sharply expressed senile changes, Steinach tied off the outlets of both testicles.

Two and one half weeks after the operation the first signs of rejuvenation appeared. The bald places on the body began to be covered with hair, the animal became more lively and more active, its appetite improved, and it rapidly began to gain in weight. The skin became glossy and clean, the posture straight, the head raised, the eyes clear. At the end of ten days after the opera-

tion there was brought into the cage of the operated animal a female rat. The rejuvenated rat became extremely excited and ceaselessly played with the new comer and followed her. Eighteen days after the operation another female was let into the same cage. The result was tireless pursuing and numerous copulations quite stormy in character; during fifteen minutes he possessed the female nineteen times. In the intervals the animal was cleaning and washing itself. When meeting the other males, the operated animal immediately entered in a fight with them and carried on actions similar to a young male. The appetite increased markedly, the animal gained considerably in weight. Its temperament entirely changed since the operation. After a short while a female, who was not in the rutting period, was brought into its cage. Immediately, there followed an extremely stormy possession in spite of the resistance offered by the female. With the normal young males even in the bloom of their sexual function, according to Steinach, nothing similar ever happens. After the removal of the female from the cage, the operated male remained for a long time in a high sexual excitement and only gradually calmed down.

Not only in a sexual sphere was the effect of the operation shown, but also in all the animal's other activities, its posture, behaviour towards its surroundings, general nutrition, physical strength heart action, general liveliness, condition of the skin, etc. The animal gives the impression of a healthy male, in the prime of its youth. (Fig. 29-30).

Such beneficial influence of the operation on the entire organism of the operated animal, physical as well as psychical, especially in the sexual sphere, continued for over nine months. Then the signs of senility began to reappear. After 36 months of age, the animal was killed for the purpose of investigation.

The brother of the operated male, that was left for control, had died with the approach of normal old age a-

bout eight months previously. Other animals of the same age died about ten months earlier.

In this manner the operated animal after reaching advanced age, was rejuvenated and its life was prolonged approximately one quarter of its normal duration.

In other males, Steinach tied the outlet (vas deferens) of only one testicle. Among such animals, as might be expected, under the influence of the increased secretion of the ligated gland, the other non-operated testicle regenerated to a new life. The latter again produced seminal cells and the operated animal was restored to its long lost ability of reproduction.

The posterity left by such males develop normally and reached sexual maturity and, in its turn, produced a strong generation.

Steinach's advice therefore, is to begin every operation for rejuvenation with the tieing of only one testicular outlet, so that the reproductive strength of the organism may be preserved as much as possible and the period of rejuvenation may be stretched over a longer time. Only when the beneficial action of the ligated gland is beginning to diminish, so that the period of rejuvenation brought about by the operation is approaching the end, and the signs of senilty appear again, should the outlet of the other testicle be tied off, and in this manner another period of prolonged rejuvenation will be produced. Of course, this rejuvenation will only affect the general condition of the organism, its physiological and psychological properties, but does not spread to the reproductive ability, for the tieing of the outlets of both glands renders the animal entirely sterile.

However, in the general constitution of the animal and in the majority of the physiological functions of the organism, there appear marked changes after the operation; the new period of rejuvenation is in no way less expressive than the one following the first operation.

It is necessary to employ such a consecutive procedure in the operation for rejuvenation, according to Steinach,

in all the future work of this field. First, the outlet of one testicle is tied off. The result is a period of prolonged rejuvenation. At the end of the latter, the second outlet should be ligated and another period of rejuvenation will follow. When the last is reaching its end, and the power of the organism itself is exhausted, then we should employ the transplantation of glands of other animals. This will be followed by another prolonged period of rejuvenation. Repeating the last method, at required intervals, we can prolong the life of the animal for quite an indefinite time. Such tests of repeated rejuvenation were partially established by Steinach.

A rat who had reached an advanced old age, was submitted to an operation for rejuvenation, in which the outlet of only one gland was tied off. After a few months, when the action of the operation began to weaken and the signs of senility reappeared, the outlet of the second testicle was tied off. Again there followed a period of rejuvenation, which continued for a period of a few months. With the appearance of the first indications of a secondary old age, Steinach transplanted into the twice rejuvenated animal, who, at that time had reached a respectful age of over 36 months, the gland of another young male. This time there also followed a rejuvenating period still more expressive than the previous ones. With this combination of three consecutive periods of rejuvenation, Steinach succeeded in prolonging the life of the operated rat to forty months, i. e., one year more than the average longevity of normal rats. Under usual circumstances, this age is very rare and almost impossible to attain. Steinach has not performed any further transplantations, leaving this field of activity to future investigators.

Hystological investigation of the testicles of the rejuvenated animals, disclosed sharp changes in their structure in comparison with the old sexual glands. It was shown that the generative glands (that is, the seminal canals), were considerably diminished in circumference.

However, the almost extinguished interno-secretory part disclosed all the indications of an intensively vital activity. (Fig. 31). The latter, must be recognized as the chief cause of all the indications of all the deep changes, both physical and psychological, that take place in the organism, as a result of the operation.

In the females, a similar operation for the ligation of the outlets of the sexual glands, is more complicated and, because of different anatomical relations, appears considerably more difficult than the operation in the males. Although Steinach, with a similar tieing of the ovaducts in the females, succeeded in obtaining a somewhat increased function in the ovaries and uterus, as well as a somewhat improved general condition of the organism, nevertheless, his decision was against considering such an improvement a real rejuvenation, in comparison to the one that takes place in the male.*

The X-ray appears to be a very powerful means of stimulating the development and activity of the feminine "glands of maturity". Steinach warmly recommends this method, as well as the method of transplantation to obtain the best results. It must be emphasized, that the chief factor in the X-ray treatment of the sexual gland is the dosage. It must be remembered that the object of this treatment is to obtain a destruction of the reproductive part of the gland and development of the interstitial portion, that is, the internal secretory elements. This is possible, because the cells of the reproductive part of the gland are more sensitive to the action of the X-rays, than the interno-secretory cells. The strength of the X-rays must be carefully selected. An extremely small dose will not kill the reproductive elements. A very strong dose will kill not only the reproductive cells, but also the interno-secretory part of the gland as well.

However, if the dosage is exact, the interno-secretory cells, as a result of careful X-ray treatment, will receive a new impulse towards a powerful development, in view

*—However, by a simple auto-transplantation I have succeeded in obtaining a very satisfactory result in one woman-patient.-Translator.

of the fact, that the reproductive part of the gland will perish and shrink in size. The result will be a more strongly regenerated function of the almost extinguished "gland of maturity".

In this manner, Steinach's tests with the rejuvenation of animals by way of transplanting the sexual glands, as well as by the other methods mentioned above, have led to quite important results. On the basis of the quoted examples, we could convince ourselves of the benefit of the operation on the organism of the animal. A decrepit, hairless, bent, old, indifferent, an entirely impotent form up till the time of operation, becomes lively, strong, improves in skin, and acquires its long extinguished sexual potency and ability to produce a strong and healthy family.

A highly important fact in all the cases of rejuvenation obtained by Steinach among animals, is that the second period of old age, which was usually followed by sudden death, was extremely different in its character, from that of the other normal animals. First, the old age that followed after the period of artificial rejuvenation was extremely short. Usually, it lasted only a few weeks. The result of the operation in this manner, was a prolonged period of rejuvenation on account of the curtailed old age. Second, the senility itself, is different character. It is marked by a sudden betrayal of a rapid loss of psychic power, complete indifference to the surroundings, followed by death. The post-mortem investigation of the animals, in accordance with the purely external observations made during the life of the animal, showed that all the internal organs were in good condition and in full bloom of vital activity. To explain the death of the animal as a result of some external cause, is quite difficult and Steinach draws the conclusion that the real cause of the death of the operated animal must be sought in the central nervous system, which was exhausted at the end and refused to serve any longer. The psychic condition of the animals before death

makes this deduction quite plausible.

These circumstances are of immense importance in general biology. We can see in the experimental proof the truthfulness of Metchnikoff's assertions about the development of the so called "fear of death". We have already mentioned that according to Metchnikoff, the fear of the oncoming death is caused by the fact that physical old age in man and in the majority of animals, usually does not run parallel with the psychological senility, but comes a great deal earlier than the latter. When a man is 70 or 80 years old and dies as a result of some physical cause, his mentality and especially the instinct of life is at the height of its development. According to Metchnikoff, this accounts for the fear of the approaching end. That is why he works for a means to attain higher longevity, in order to enable the instinct of life, as well as other psychic properties of the organism, to complete the cycle of its development and in this manner to prevent the approach of physical senility earlier than the mental. If this were attained after the life of man were increased to its normal limits, then about the time of death his mentality would have gone through the entire cycle of development, then the fear before the approaching death would disappear; old age would become more natural, and death—one of the necessities of the organism. Such was the train of Metchnikoff's thoughts. Their realization can be seen in the fact that, when the animals were operated on by Steinach, their prolonged condition of rejuvenation was followed by a short psychical senility, leading to a painless death. In Metchnikoff's reasoning and Steinach's experiments, we can, therefore, find new points of contact in the thoughts of the two investigators.

In this manner the problems of Steinach as a physiologist in the laboratory, were completed according to his own acknowledgment. It was now necessary to make the next step and try the results of these experiments on hu-

*However, by a simple auto-transplantation I have succeeded in obtaining a very satisfactory result in one woman patient. Translator.

man beings. This Steinach did. Encouraged by the wonderful success of his tests on animals, Steinach induced one of his co-workers, Dr. Lichtenstern, to perform the operation for rejuvenation on man.

As far as the application of the method was concerned, it is clear that at first they employed the easiest to be performed, that is; the ligation of the outlet of (vas deferens) the sexual gland. It is important to note in order to estimate the results of Steinach and his co-workers, that the patients were subjected to the operation not for the purpose of rejuvenation, but for many other reasons, so that the tieing of the outlet of the gland was undertaken without the patient's knowledge. Consequently, the influence of auto-suggestion was in this manner, entirely removed. That the latter is of importance, we have already seen, when we were discussing the numerous means that were offered at various times, for the prolongation of human life. Steinach took this fact into consideration. The weak, old men operated on by Lichtenstern, do not know up to this very day, that they underwent an operation for rejuvenation, and are absolutely unsuspecting of the real changes that followed the operation. Steinach illustrates this with the following cases.

The first case deals with a prematurely aged worker forty-four years old, who entered the hospital on account of his general weakness and severe pain in both testicles. The patient made a very bad impression, was greatly emaciated, with flabby muscles and deep wrinkles on his elderly looking face. Finally, he became incapacitated for any physical work, was easily fatigued. For quite a number of years he had suffered from impotence. Physical examination disclosed two hydroceles, which necessitated surgical interference. During the operation, Lichtenstern tied the outlets of both testicles without the knowledge of the patient. Eight days after the operation, the wound healed and the patient was discharged from the hospital. After two or three months a sharp change took place in the condition of the patient. The wrinkles

began to disappear and the patient gained considerably in weight. At the end of another three months, his strength had so increased that he could easily accomplish the work of a porter and could readily carry on his back weights of from 250 to 280 pounds. His muscles, especially those of the extremities, became strongly developed. The hair on his head became thicker and disclosed a more intensive growth. The patient had to shave himself more often than before. A still greater change took place in his sexual life. The long extinguished sexual desires reappeared. One year after the operation, the patient had gained about thirty pounds in weight, notwithstanding the food problem in Austria in 1918. The beneficial influence of the operation has continued till this very day. Over two years have passed since the operation, and the patient with his lively appearance, erect posture, face free from wrinkles, still appears to be a strong young man.

A similar operation with equally satisfactory results was performed by Lichtenstern on a seventy-one year old man, a director of a commercial firm. The latter was placed in a sanitarium because of an ulceration of the left testicle. In view of the extremely severe infection, it was decided to remove the diseased organ entirely. During the operation, Lichtenstern again without the least suspicion on the part of the patient, tied off the outlet of the second healthy testicle. Three weeks later the patient left the sanitarium. We must also note that besides the acute suffering, which brought the man to the surgeon, the patient had suffered for many years from a pronounced arterio-sclerosis, dizziness, weak heart, was easily fatigued, marked tremor etc. The sexual feeling had been entirely extinguished for the previous eight years.

A few months after the operation definite changes appeared. All the senile characteristics began to fade gradually, his appetite improved, the tired feeling and the difficulty of breathing were gone. The patient now is

frequently on his feet for hours. The arterio-sclerosis from which he had suffered for many years vanished. The attacks of dizziness ceased, the hands of the patient which had definite tremor before, became unhesitating and capable of the most delicate motions. The growth of hair on the face became more intensive. The patient shaved more frequently. Profound changes also took place in the mentality of the patient. His frame of mind previously depressed, became livelier and more cheerful. His long lost ability for clear thinking was restored. People with whom the patient came in contact, did not believe his true age. Particularly striking alterations took place in his sexual life; erotic dreams have returned and the old man was compelled to look for some natural means. When found, he experienced a satisfaction which was known to him only in his early youth. In a lettter to Dr. Lichtenstern nine months after the operation, the patient characterized in detail his general condition, concluding: "My health and well-being have returned to me, my general condition does not leave me anything better to desire.

Since then, quite a few years have elapsed. The seventy-two year old man is even now in a condition of prolonged clearly expressed rejuvenation.

It is interesting to note, that lately, Lichtenstern could disclose in his patient another sign of rejuvenation which was absent before. In the thin colorless growth, in the region of the genitals, there appeared numerous dark colored hair. This circumstance has an enormous significance in the estimation of the result of the operation. First, it undoubtedly speaks in favor of the rejuvenation of the entire organism for the natural change of all grey hair into young, dark, richly pigmented hair, can hardly be explained in any other way. Second, the appearance of this symptom, a long time after the operation, shows that the process of rejuvenation does not take place immediately after the operation. Apparently this process is prolonged, the signs of rejuvenation continue to accum-

ulate, and may require many years before they reach the highest point of development. One is impressed by the fact that the process of senility of the organism is, as if turned in the opposite direction after the operation, it seems as if old age gradually approaches the point from which it had originated.

Steinach and Lichtenstern have obtained similarly favorable results in all the other instances of artificial rejuvenation. Lichtenstern has at the present time about thirty such cases. The material is gradually increasing. Little by little we begin to hear of analogical cases from other surgeons, who have employed Steinach's method. A detailed review of all these instances is still more convincing of the beneficial action of the operation on the organism of old men. The two examples of rejuvenation mentioned above, are suggested to give us a clear picture of what changes take place in the senile organism, under the influence of the operation.

Such are the results of the operation in men.

How then, about women? It is not difficult to guess that the interests shown by the representatives of the fairer sex towards the operation for rejuvenation is considerably greater. Their persistant desires to obtain immediately "without delay or excuses" an answer to this question is easily understood.

When discussing the tests in regard to rejuvenation of animals it has been pointed out that the operation for the ligation of the ovaducts in the females is accompanied with considerably greater technical difficulties, and is not crowned by the same results so successfully obtained by a similar operation in the males. However, among the females, as we have already seen, effective results are produced by the transplantation of young ovaries. With such transplants, it was not only possible to restore to the old female her faded youth, but to re-establish fertility and make possible the production of children. By analogy with the experiments on the animals, it was reasonable to believe, that by the transplantation of young

ovaries into elderly women, one could revive their lost youth. This supposition was strengthened by the numerous results obtained by the operation of rejuvenation among males. The old feminine dreams of a lasting youth, which is more tempting and fascinating to the woman, appears accomplished at last. Nevertheless, from the very outset, the difficulty which was to be met in its practical realization of this dream, became apparent. The fact is that there can hardly be found a subject, who would voluntarily sacrifice this valuable material for transplantation. We have pointed out above, when discussing the applicability of this method of transplantation among human beings in general, that the difficulty becomes more apparent when the subject of the fair sex is approached. Here it is still more doubtful whether a woman can be found, who would voluntarily part with her own source of youth, especially for the sake of another woman. Of course, the method of producing by culture of the organs outside of the organism and the success of auto-transplantation, may, in the future, bring unexpected results. It is clear, however, that the woman may not wish to wait and relish hopes, especially at a time when before her own eyes there is brought about a rejuvenation of men.

Steinach recognizing this, took into consideration the result he obtained in animals with the X-ray treatment of the ovaries, whereby, the withering gland of maturity is regenerated. He induced one of his co-workers, who frequently used this treatment for various conditions of the uterus, to follow up some of his cases with the object of observing the rejuvenating action of the rays. The result of these observations, have apparently justified the hopes placed on the treatment. Approaching old age, after the application of the X-rays, was apparently checked in its further development. Moreover, there appeared in the condition of the organism a series of deep alterations, which could be explained only by the return of the patient's youth. The tired feeling and general weakness,

are characteristic of old age, disappear in the female patients. The physical and mental working capacity came back to life, the wrinkles on the face faded, the skin became more elastic, acquiring a fresh, livelier appearance. The patients gained in weight and became happier, more cheerful, and invigorated. Furthermore, he noticed a series of other beneficial influences, both physical and mental, as a result of the X-ray applications. They were quite similar to those obtained in man by means of the ligation of the outlet. Regarding the changes in the sexual sphere among the female patients it was impossible to obtain any data on account of the delicacy of the subject involved.

In this way a means for rejuvenation was also found for women. The X-ray could, to a certain extent, replace the operation, which at the present time, on account of obvious technical difficulties, cannot have a practical application.

The mechanism of the action of the X-ray on the ovaries of elderly women, is quite clear. Its action is the same as on the testicles. The destruction of the reproductive part of the gland and a splendid growth of the interstitial tissue are the main results seen after this treatment. The regenerated gland of maturity producing a specific hormone shows a rejuvenated action on the entire organism of the woman.

This ends the chain of wonderful experiments of Steinach, which were devoted to the question of the action of the internal secretion of the sexual glands and their influence on human organism.

We have seen that the object of the first experiment was very modest, but gradually, as the scope of the problems put forth by Steinach grew bigger and wider, the investigator became more confident. From a very insignificant experiment with the action of an extract of an ovary on a castrated frog, begun by Steinach twenty-eight years ago, he finally attempts to solve, through an enormous series of intermediate steps, a wonderful problem of

artificial rejuvenation and prolongation of human life. However, the last problem is not the only thing, as we have seen, that seemed to interest the investigator. All the intermediate results, which Steinach had obtained on the way to his goal, will occupy in the history of man-kind a similarly great place. An explanation of the action of the hormones on the physical constitution of the animal, as well as on the entire nervous system, the wonderful tests with the transformation of males into females and vice-versa, the solution of the enigmatic problem of the sexual anomalies, and particularly the discovery of the true nature of homosexualism and hermaphroditism, which as we shall show later, form a new and entirely unexpected foundation for the solution of a whole series of social problems in connection with sex this is, the result of the enormous investigations, which ended during the last few years with the daring and original attempt to realize the eternal dream of artificial rejuvenation.

We have pointed out above, when discussing the longevity of life of various animals the close relationship existing between the function of propagation and the length of life of the animal. We have seen that animals show longer or shorter life, in proportion to their importance for the preservation of the species. The life of the individual is preserved only up till the time it is able to produce posterity, in other words, until the sexual glands lose their activity. With the fading of the latter, the organism loses its significance for the species and therefore perishes. From this begins the process of senile degeneration, ending in death of the animal. Hence, the significance of the organism for the species is measured by the amount of the vital activity of the sexual glands. It is not surprising, that nature put into these glands the source of the strongest influence on the organism, because they produce the specific hormones supporting its activity at a definitely high plane. On the condition and function of these glands depend the longevity of the animals and by their regeneration we can evoke a rejuven-

ation and prolongation of life of the entire organism.

In this manner the sexual glands occupy a most important place in comparison with the other organs of the animal, having unique significance in the preservation of the species and, consequently, playing an exclusive role in the general development of the animal kingdom. This latter fact, has an enormous biological significance, and we shall consider it again in the critical review of Steinach's results. Here we shall just point out, that in this particular significance of the organs of propagation, in this close relation between the vital activity on one hand, and the perpetuation of the species on the other, we can see one of the most weighty arguments in favor of the correctness of the theorectical views of Steinach, as well as their practical application. In this course chosen by Steinach, lies the colossal scientific and philosophical importance of his biological foundation.

CHAPTER X

THE CRITICAL ESTIMATE OF STEINACH'S EXPERIMENTS, SUPPORTERS AND ANTAGONISTS.

In the previous chapters the chief results of Steinach's works in the field of internal secretion of the sexual glands were reviewed. We may state that the entire biology of sex was placed by this investigator on an experimental foundation, and there can hardly be found in the entire contemporary sexual biology, even one chapter which may not have to be worked over on the new basis obtained by Steinach and his school.

Nevertheless, in spite of the wonderful pages contributed by Steinach to the history of scientific research, it would be a grave mistake to suppose that his scientific reports have always met with agreement among the other investigators. Like every other great scientific discovery, Steinach's announcement of the experimental solution of the problem of rejuvenation after a short period of enthusiasm and acknowledgment, has evoked a series of doubts, questions, replies and attacks, in which purely scientific arguments were frequently intermingled with personal feelings and motives, having very little in common with science. This abundance of criticism, devoted to Steinach's experiments can be divided into several classes, much is entirely undeserved, and with only slight foundation, while some is undoubtedly true, but they all help in a large measure to explain the real condition of the matter. Undoubtedly, it is highly desirable that the reader become acquainted with the chief points of dispute in Steinach's theories, and the replies offered against them. In this manner he may obtain his own conception and significance of Steinach's works, which will corres-

pond to the level of its present scientific understanding. At the same time, this will spare the author a reproach, that he attempted to direct the thoughts of the reader in only one direction. Moreover, this onesided treatment of the question, is least desirable, and is something the author wishes to avoid. Not with the description of a few overawing facts, not with the presentation of a beautiful scientific thought, did the author intend to fascinate the reader's mind, but to bring him into the very depth of the ideas touched upon before, to awaken his critical sense, to generate a series of new questions which, as a result, will strengthen and develop the desire for truth. This is the author's aim in his present work. But it is clear, that for the attainment of this aim, it is important, not only to acquaint the reader with the course of thoughts of Steinach himself, but with the cycle of all the other ideas, which, during many years, Steinach's opponents have been developing with no less obstinacy. Only an unprejudiced presentation of the subject with all the pros and cons of Steinach's views, only an impartial analysis of all the conditions, only this will enable the reader to familiarize himself independently with the rich and unusual material obtained experimentally by Steinach's school.

The presentation of the subject in this manner, seems important for other reasons. Some investigators may deny these or the others of Steinach's data, or may express objections to his explanation of these results. However, it is regretable to note, that these objections are made still more categorical in form by persons, who, in general, know very little about the real nature of the problems. Furthermore, it is a known fact, that no one is so much inclined to undue scepticism than the persons who acquaint themselves with the subject, either through some casual remarks or through short newspaper reports.

The most frequent objection heard against Steinach's proposed operation for rejuvenation, consists of the following: the immediate result which appears in the organism following the operation both in human beings and

in animals, is the increase of the sexual instinct and regeneration of the sexual function. Here, the opponents of Steinach cannot agree to the fact, that the regeneration of only one organ could affect a rejuvenation of the entire organism. They say, that with the admitted increase of a sexual tendency and sexual requirements of the organism the entire effect of the operation is exhausted. To call such a reinforcement of the sexual instinct, a general rejuvenation, is hardly permissible, because by the latter we understand a regeneration of all the functions and capabilities of the whole organism, and not a one sided flash of some unique function. Still less can be expected, Steinach's critics maintain, in regard to a beneficial result in the prolongation of the life of the individual. On the contrary, this excessive and sudden increase of the sexual functions, which is the usual result of the rejuvenated animal, makes an unexpected and too heavy demand on the senile nervous system. This should lead, inevitably, to a sudden and premature exhaustion of strength of the central nervous system, which normally could have lasted for a long time, for the execution of the ordinary necessities of the organism. In other words, according to these views, Steinach's operation, which leads exclusively to the regeneration of the sexual function of the organism, may result, as a consequence,--not in the prolongation of life, but in its shortening. This deduction seems justified by a series of observations made in our everyday life. The marriages of old men with young women prove usually fatal for the former in a very short time. Apparently, in these cases, the sudden and excessive demand made by the sexual sphere on the old organism and especially on the central nervous system, causes a premature exhaustion of strength and sudden death. Moreover, the critics wish to see in some of the instances of Steinach's experiments, something that gives them a ground for these deductions. As was evident from the reports of Steinach's tests, the rejuvenated animal after spending some time in a condition of newly ac-

quired strength, suddenly fell into a state of senile decrepancy and very soon perished. We further note that the internal organs of the dead rats have been found at the autopsy to be in very good condition and, therefore, it appears extremely difficult to explain the cause of death of the animals by any disease. There was left only one supposition,--that death came as a result of a sudden exhaustion of the central nervous system. The sharp lowering "of the mentality" of the animal before death also speaks in favor of this supposition. We have previously, pointed out the explanation Steinach gives regarding this fact. His opponents, however, make entirely different conclusions and wish to see in this fact a more weighty reason for their fears.

We must admit that the course of thought of the critics, as they were outlined, is markedly rational. The facts themselves, on which they base their arguments, in general correspond to reality. The precedence on which they make all deductions are quite justified and their conclusions seem quite logical.

What is the answer?

First, the assertion, that the regenerated activity refers to only one sexual sphere of the animal is a mistake. We have previously seen that not only is the sexual function revived, as a result of the operation, but that there appears a series of noted changes in the psychical and physical state of the entire organism. The improvement of the general condition of the body, the new influx of energy and vitality instead of the previous condition of apathy, the quite noticeable increase in physical strength instead of the former decrepancy, the appearance of a new growth on the former bald places, the improved blood supply of the musculature and internal organs instead of anemia, the strengthening activity of the heart and lungs, the marked change in appetite and considerable gain in weight,--these are phenomena, which can hardly be ascribed to the sexual regeneration of the animal. Steinach's opponents refused to see these altera-

tions as obstinately as if his reports did not contain them at all.

Second, statistical data brought up by Steinach, show beyond any doubt, not a shortening of life of the operated animals, but a prolongation on the average of one fourth of its normal duration. In the experiments, where the operation for rejuvenation was performed twice and three times, it was prolonged for a considerably greater period by one third of normal life. If the nervous system became finally exhausted, it was not prematurely, as the opponents of Steinach wished to see, but at the end of many months, after the animal reached a normal limit of its life. The fact of the exhaustion of the nervous system cannot be doubted. Steinach's opponents obstinately lose sight of the time at which this exhaustion takes place. All this makes the whole difference in the decision of the question.

Finally, according to the reasoning of Steinach's opponents, they deny, a priori, that the revival of only one organ could evoke the rejuvenation of the entire organism. It may be said that Steinach himself agreed with this to a certain extent. But the fact remains, that after the operation there appears, as a result, the rejuvenation not only of one sexual gland, but of the entire system of glands of internal secretion, that a series of glands possessing this activity, such as the pancreas, the thyroid, the pituitary body, the suprarenal glands, the sexual glands and others, influence very strongly the course of the most important and responsible functions of the body. Let us recollect for an example, the role of the thyroid and pituitary gland in the life of the organism. To what deep changes in the physical constitution and psychical activity will lead the disturbance of their function. What strong influence they exercise on the higher ability of man! What sharp changes in the growth and development of the body appear as a result of a surgical removal or underdevelopment of these glands!

Here, it appears, that all the above mentioned organs,

powerfully influencing with their internal secretions, both the physical as well as the psychical world of the animal, are found to be connected in the closest functional relations, as if forming one close chain, in which any changes in one of the links, inevitably reflect on the condition of the rest of the chain. Should anything in one form or another, react on the pituitary body, a series of marked changes would immediately appear in the suprarenal and sexual glands. The disturbance of function in the latter, in turn will provoke a new series of disturbances in the activity of the thyroid gland, in the pituitary body etc. This very cooperation of the united hormone-producing system, explains the success of Steinach's operation, and its enormous influence on the various functions of the organism. Steinach, himself, did not admit that all these deep changes in the organism of the animals and men which appear after the operation, are the results of the influence on the organism of the sexual glands only. He supposes that in this instance, outside of the direct influence on the organism of the internal secretion of the rejuvenated sexul gland, an indirect influence also takes place through the cooperation of the other endocrine glands, which enter into the making of the chain of the hormone-producing system. In favor of this supposition, speaks a series of observations previously made by Steinach and by one of his co-workers. They succeeded in proving, that after the operation for the removal of the sexual glands of the animal, there is noticed a number of characteristic changes in the thyroid gland and the pituitary body. Particularly interesting and important is the fact that similar changes as a rule, are observed in the same organs at old age. We know that this circumstance was one of the factors which led Steinach to his experiments of rejuvenation.

Steinach, in this manner, could prove beforehand, that the normal vital activity of these two most important organs of internal secretion, namely; the thyroid and pituitary, are supported at a definite height by the function of

the sexual glands. Hence, it is quite natural to conclude that the result of the operation for rejuvenation, reviving the interno-secretory function of the sexual glands, should regenerate the extinguishing function of the thyroid and pituitary. The latter, in turn, could exercise a strong influence on the course of all vital processes, and in this manner promote to a considerable degree, the rejuvenation of the entire organism. Therefore, we must consider the result, not only as a rejuvenation of the sexual glands, but of the entire hormone-producing system. Following the above considerations and in order to verify them, that is, to establish in practice, the alterations which the operation brings about, not only on the sexual glands, but also on the other secretory organs, Steinach induced one of his co-workers, Dr. Schlidt, to examine under the microscope the thyroid gland and the pituitary body of several rejuvenated rats. In this case, following his usual rule, and desiring to exclude any possible influence of preconception on the result of the investigations, he did not inform his co-worker about the character of the material,--that it had been taken from the artificially rejuvenated animal. The examination was made with all possible care. It was shown that the thyroid gland as well as the pituitary body disclosed an entirely normal structure of young, well functioning organs. The senile changes usually found at this age, could not be established.

Hence, it was proven, beyond any doubt, that the rejuvenated sexual gland exercises a strong influence on the condition and function of the other interno-secretory glands. That the action of the operation on rejuvenation is not influenced by the direct stimulation of the organism by the glands of maturity alone, but by a series of numerous indirect influences, through the medium of other endocrine glands, such as the thyroid and the pituitary. In this manner, the preconceived judgment of Steinach's opponents, that only one organ is rejuvenated as a result of operation, appears incorrect. The investi-

gators whom we have mentioned, speak in favor of the fact, that the entire hormone-producing system is undergoing deep alterations and is regenerated in its activity. The latter in turn leads to the rejuvenation of the entire organism.

It is interesting to note, that the results of these investigations correspond fully with general scientific and philosophical considerations, which we reviewed earlier. The changes of any given link in this closed chain of the interno-secretory organs must be accompanied by deep changes in the entire system. This holds true especially when we are dealing with the most important link namely: the sexual glands, which, as we have already seen, occupy an entire exclusive place in comparison with other organs of the animal: first, on account of the particular role they play in nature, and second, because of their importance for the preservation of the species. Therefore, it is not surprising that in this particular organ, nature has inclosed the most powerful stimulus for the development of the vital activity of the entire hormone-producing system. With the regeneration of the almost extinguished function of this organ, not only the entire chain of glands of internal secretion, but the whole organism is revived to a new activity, similar to that of the past youth.

So, the chief supporting points of the objection are broken down. However, this does not necessarily mean that the problem of rejuvenation is entirely solved. On the contrary, it is quite possible that an entire series of functions of the organism are still beyond reach of rejuvenation. And here we may suppose, that a combination of transplants of a few interno-secretory organs like the sexual glands, the pituitary body and the thyroid, may finally lead to the solution of the old problem.*

Another objection, which is frequently expressed against Steinach's operation, refers to the question of the

*Report to the society of Russian Physicians in Germany, Nov. 26, 1920. Ishlondsky.

ability of the operation to prolong life in the operated animal. Some critics point out that the age reached by the rats operated on by Steinach, is sometimes met with among the same animals without the operation for rejuvenation. The quoted case of the operated female that became pregnant two months after the operation, being twenty-four months old, is also considered as a usual appearance.

This objection is based at its best, on a misunderstanding, emanating from an incorrect use of figures. The age reached by the operated rats may possibly be obtained even without an operation. However, this is not an ordinary occurrence, but a rare exception. Steinach, on the other hand, gained this average prolongation of life in all the operated rats. The normal longevity is usually eight months less than the age attained by the operated animal. Steinach repeatedly emphasized this fact, and in his experiments for rejuvenation always left for control side by side with the operated animals a few of their brothers. These were rats of the same breed, from the same parents and they were kept throughout the experiments, under the same conditions of nourishment and general care, as the operated rats. Even then, the control animals died eight or nine months earlier than the operated brother, in spite of the fact that their general origin and physical constitution, and, consequently, their chances for longevity were the same. This argument is undoubtedly very weighty in favor of the prolongation of life as a result of the operation.

We cannot compare, as Steinach's critics have done, the figures indicating the highest limit of life among rats, with the average longevity of life of the animals operated on by Steinach.

The objection, regarding the late breeding of the operated female rat can also be eliminated. It is true that females sometimes become pregnant even at this age, but it is important to note that the operated animal had not been pregnant for almost an entire year, up till the op-

eration. This female had, therefore, lost all her reproductive ability, not having even any exciting influence on the young males. This fact is quite indicative of the true condition of the female. The chief point in Steinach's experiment is not the fact that a female rat became pregnant at the age of twenty-four months, but that such an impotent animal, that had not shown any signs of reproductivity for many months, could become rejuvenated and produce offsprings after the operation.

We cannot compare meaningless figures and objects. Only homogeneous quantities are comparable. In this course, illogical mistake, lies the source of the quoted objections.

Furthermore, Steinach's critics frequently point out the fact that operations similar to Steinach's were performed quite often by surgeons in former times. That is true,--but the operations were not performed with the object of rejuvenating the organs, but for other reasons. A similar operation has been practiced for many years in some states of America for the purpose of sterilizing the criminals. Nevertheless, no one has ever succeeded in establishing the rejuvenating action of the operation, which Steinach and his co-workers described. It is difficult to imagine the authors of the present objection, state, that such sharp changes in the condition of organism, which, according to Steinach, appear as a result of the operation, could pass unnoticed by the other surgeons. That is why Steinach's critics think, that the cause of all the beneficial results obtained by Steinach and Lichtenstern in their operation on human beings, must be sought, first of all, in the removal of the cause from which the patients were suffering. These opponents claim that this favorable action of the operation, is based on the auto-suggestion of the patient, or on the overestimation of the results of the operation by the surgeons themselves.

Regarding the reference of the critics to the operation, that it has been performed before Steinach, we should take into consideration the following circumstances.

First, the rejuvenating action of the operation did not attract any particular attention, undoubtedly, because the entire effect of the operation was ascribed to the removal of the diseased condition. Second, it is important to remember, that during the operation the surgeon must be particularly careful not to include in his ties, the nerve and blood supply of the testicle. Otherwise, the latter, deprived of its innovation and nourishment will inevitably perish. Such a simultaneous ligation of the seminal outlet, nerves and blood vessels of the testicle, could easily take place since the object of the operation was not to maintain the interno-secretory action of the interstitial gland of which the surgeon at that time had no conception, but to exclude the testicle from the sphere of action.

Furthermore, we should take into consideration the following fact, that this operation employed by surgeons for the hypertrophy of the prostrate, has frequently not justified his expectations. At times, it proved entirely useless, and in some cases even dangerous, in view of the fact that in a few instances it was followed by the destruction of the testicle. That is why it was almost impossible to note any rejuvenating action of the operation. However, in those cases where the operation was apparently performed technically correct and no complications arose, the surgeon really succeeded in establishing improvement in the general condition of the organism. About these observations, spoke the surgeon, Kummel, at the conference of physicians in 1920. Nevertheless, all the observed improvements on the general state of the operated patients were erroneously ascribed to the removal of the diseased condition.

Finally, Steinach's opponents refer to the sterilization of criminals in whom the outlets of the testicles are tied off. In these cases they point out, there were not noticed any symptoms of rejuvenation although the operation is performed as are the operations of Steinach. It is clear, however, that in these cases, the operation in its essence and ultimate purpose, could not pretend to those techni-

cal precautions employed by Steinach and Lichtenstern. In the majority of these operations the blood vessels and nerves that are in the neighborhood of the outlet, were undoubtedly included in the tie, so that as a result, the testicle underwent a degeneration. It is selfunderstood that no rejuvenating action could have appeared in such cases. Besides, Steinach's opponents lose sight of the fact, that the majority of criminals are young people and, consequently, in such subjects, it would be difficult to denote any indications of rejuvenation. As one noted German biologist jestingly remarked: "Old men, as a result of the operation, turn into youths, into what then, I pray, do they expect young men to change--into infants?"

The authors of the above mentioned objection, explains the favorable results obtained by Steinach's operation, by the removal of the fundamental cause of the illness, and by the influence of preconception on both the patient and surgeon. This explanation, however, holds very little conviction. First, the similar and almost identical results were obtained by the same operation both in man and in animals. Second, we cannot ascribe to the removal of the underlying causes for which the patient was operated on, the disappearance of obvious symptoms of senile decrepancy, which take place a great deal earlier than the beginning of the illness.

Finally, as far as the question of prejudgment is concerned, the patients did not suspect either the fact or the meaning of the operation to be performed, and the very result of the operation was decidedly not limited to subjective symptoms. There followed a series of purely objective changes in the organisms of the operated patients, such as the reappearance of hair on the body, increase in weight, improvement of the condition of the heart and lungs and the ability to carry heavy weights after the operation. All these factors can hardly be attributed to the subjectivism of the surgeons or the patient.

Some of Steinach's critics, further point out the fact that the increased development of the interstitial tissue

of the sexual gland, is provoked, not only by the above mentioned manipulation, like the transplantation or the ligation of the outlet, but also by a number of poisons, such as alcohol, nicotine, or iodine etc. It is difficult to see, how the action of these poisons, which have a destructive influence on the organism, killing every vital activity should produce rejuvenation. This argument appears to be a result of a complete misunderstanding of Steinach's work. First, we should take into consideration, that in the interstitial tissue we must differentiate two kinds of elements: cells of purely connective tissue, which are in this case, of no significance and having no definite role in the interno-secretory activity of the sexual glands, and the specific Leydig's cells, the cells of the "gland of maturity", possessing the power of internal secretion. During the examination, they are frequently mixed and mistaken. However, only the latter can play an important role in the process of rejuvenation. Therefore, the excessive growth of the connective tissue as the result of a chronic poisoning by alcoholism does not necessarily mean an increase of function of the gland of maturity.

Second, if the fact of the development of Leydig's cells, as a result of the irritation of these poisons were established, then it does not necessarily follow that this will lead to rejuvenation.

The object of the operation for rejuvenation is not to produce an increase in size of the gland of maturity or to increase the number of functioning cells. For even in certain conditions, the structure and activity of the interno-secretory gland may increase in size, and yet only manifest a distorted action, accompanied by severe disturbances of the entire organism. It is sufficient to remember, for example, the diseased enlargement of the thyroid gland among cretins. This same may be applied to the "gland of maturity". The chief object is not to have the cells, poisoned with either alcohol or nicotine, multiply in number, but to strengthen the normal interno-

secretory action of the healthy cells. It is quite another thing to evoke to a new life an old but generally healthy interno-secretory cell or a diseased cell altered and distorted by various poisons. Of course, those who expect the appearance of their second youth, after poisoning their system with alcohol to such an extent that the interstitial tissue of the sexual gland will increase, will be greatly disappointed. Not only the quantity of the functional glands is important, but also their quality, their condition and character of activity. This important factor should not be forgotten in consideration of the working capacity of the various organs of internal secretion in general.

A very original objection against Steinach, an objection hardly deserving a reply, was made at one time by Prof. Fiebiger. Viewing the photographs that accompanied Steinach's report, Fiebiger noticed that some of the mice, for tests were suffering from a severe form of itch, whose origin, as it is known, is due to the entrance into the skin of a certain form of parasite.

Everything that Steinach considered as indications of old age in his experiments with animals, namely: loss of hair in certain places, lack of appetite, loss in weight, marked weakening in the sexual function, psychical depression etc., all these are in Fiebiger's opinion, a result of the itch. He claims these are manifestations of a definite parasitic disease, not specific signs of old age. Considering the result obtained by Steinach, there appears nothing else, but a recovery from an illness and not a rejuvenation. As to the rather unusual action of the operation on an itch, Fiebiger does not express any opinion, and limits himself with the establishing of the facts only.

To illustrate the expressed view and in an attempt at supporting it, Fiebiger quotes the following case. The 30th of June, 1921, he obtained a female rat with a clearly expressed itch. The body was bald in numerous places, many parasites were present in the hair. The presence of parasites could also be demonstrated in the deeper

layers of the skin. The animal looked emaciated. This condition remained unchanged at first, but about the beginning of August, the animal became worse, the amount of baldness increased, the loss in weight more noticeable, the animal became entirely indifferent to surroundings, did not leave the cage even for food. Its weight on August 16 was 140 gms.

On this day the animal was transferred to the clinic, where a corresponding course of treatment was instituted. The success was astonishing. After only a few applications of an ointment, the appetite returned, the numerous infected places on the body disappeared, a growth reappeared on the bald spots and the subjective condition markedly improved. The animal began to leave its cage for food and gained in weight considerably. On the 10th of September, the treatment was discontinued. The hairy covering was thick, fresh and glossy, the animal's appearance was well nourished, its weight was 172 gms, which represents an increase of about 32 gms, one fifth of its general weight. This result was obtained within four weeks.

In this manner, the animal presented at the beginning all the indications of old age. After a weeks treatment, one could readily declare it rejuvenated. However, all those deep alterations in the physical condition, as well as in the conduct of the animal, were a result of a short treatment of the itch. A complete cure was not obtained, but the desired improvement in the diseased process had undoubtedly followed.

From the above, Fiebiger makes his deductions regarding the real significance of the changes obtained by Steinach, as a result of the operation. In connection with this, Fiebiger, points out the fact, that it is important to employ for the experiments, healthy animals not exposed to any parasitic diseases. Fiebiger's objection quite interesting, is biologically, but rather unexpected to both himself and Steinach. The true explanation of Fiebiger's observations, we shall discuss later. For the time being,

let us see how Steinach defends himself against these arguments. In his reply to Fiebiger, Steinach points out that the alterations in the hairy growth composes just one symptom of the general picture in the senile changes of the experimental animals. By repeated operation, he could return to the animal its lost youth, several times. Finally, such indications, as the appearance of the rutting period, which was absent for over a year up till the operation and other signs could not be recognized as a result of curing the itch.

In conclusion, Steinach points to the fact that the operation for rejuvenation is now performed on a great number of people in many cities and countries. The result of it, was the return to many old men of their vanished youth, working ability and happiness. It is only just to say that with these facts Fiebiger's observations are not entirely refuted. At the same time, Steinach treated this objection quite bitterly and characterized it as a fairy tale, which one more proved the injustice of those attacks he had lately suffered.

The controversy between Steinach and Fiebiger is an interesting example of a scientific discussion. It is beyond doubt, that Fiebiger is wrong in his deductions, but so is Steinach, considering the manner in which he is trying to deny the fact noted by his opponents.

The truth is, that all the changes in the hairy covering, as well as the other symptoms pointed out by Fiebiger, may really be attributed to a disease of parasitic origin. It is quite possible that among some of the experimental animals, there could be proven the presence of parasites in the deeper layers of the skin. Nevertheless, Fiebiger is wrong in his deductions. It is true, that if the symptoms pointed out by Fiebiger, must be looked upon as a disease, then it is a disease clearly connected with old age. Here is the reason. The young healthy skin possesses a considerable resistance towards parasites and their action. In case of a severe wasting disease, especially of an infectious character, the above mention-

ed ability of the skin to resist the harmful action and spread of the parasites is markedly weakened, (Ishlondsky). As a result of this, the parasites attain the ability to multiply more readily, not only on the surface of the skin but also in its superficial layers, and may provoke a fatal outcome on the entire organism. Particularly interesting in this case, is the fact that the tendency to parasitic infection among children is still more prevalent. With the appearance of sexual maturity, it is definitely decreasing. Later we shall explain this occurrence.

It is evident, that by employing some ideal disinfection the disturbances of parasitic origin may be entirely eliminated. But under ordinary circumstances, such a disinfectant is out of the question and we cannot help coming in contact with various parasites. Only then, may the degree of predisposition of the organism towards these diseases and its power of resistance be shown.

What is the cause of this manifestation? In our opinion its roots must be sought in the internal secretion. (Ishlondsky). Normally, the secretion of the skin apparently has a defensive action against the parasites and prevent their spread. In case of wasting diseases, this resistance of the skin, in regard to parasitic infection, is considerably weakened, as a result of the disturbance of the interno-secretory action of the organism. Quite interesting is the noted fact that children are particularly predisposed to parasitic diseases. With the appearance of sexual maturity the resistance of the skin is, in this sense, greatly increased. This indicates a very significant fact. The hormones of the sexual glands have a defensive mechanism of the organism, in relation to the dermal parasites (Ishlondsky). In old age, when the internal secretion of the sexual glands is diminished, the resistance of the skin to parasitic invasion is decreased accordingly. That is why the old rats become quite unclean. It is interesting that Steinach noted in all his reports that uncleanliness is the invariable compan-

ion of all the old rats.* It is quite probable that the rats frequently become the victims of these parasitic infections. But all these illnesses are at the same time, to a certain degree, results of old age, that is, of the weakening of the interno-secretory function of the sexual glands. The latter caused a marked lowering in the resistance of the skin to the parasites, with which it came in contact, and creates a favorable ground for their invasion. The very fact that such old rats become most frequently the victims of the parasites, has apparently not escaped Fiebiger's observations, although he was unable to give it a proper explanation. From this standpoint, Fiebiger's objections may rather confirm Steinach's views than refute them. Thus, in the light of the expressed views, the manifested cure of the itch in old rats as a result of Steinach's operation, becomes quite clear and should be considered as a result of the regeneration of the interno-secretory activity of the sexual gland. The latter in its turn, has evoked an increased resistance of the skin of the animal towards the parasitic infection. In vain, did Steinach fear Fiebiger's observations and in vain is he trying to weaken their significance. Personally, I am inclined to give these observations a very important place. I see in them a weighty argument in favor of Steinach's views, regarding the influence exerted by the revived sexual glands on the entire organism of the senile animal.

This is the true significance of Fiebiger's observations. They are undoubtedly interesting and valuable, but explained wrongly by both, Fiebiger as well as by Steinach.

Of greater importance are the objections to the alterations, taking place in the physical as well as the psychical sphere, of man and animals, following Steinach's operation.

*In my report to the Society of Russian Physicians in Berlin in November 1920, I first expressed the view, that predisposition of Steinach's rats toward parasites, is a sequence of the biological changes exerted on the skin. This complication is also a sign of old age, removed by the operation.

Soon after the publication of Steinach's works, numerous investigators undertook to verify the experiments of artificial rejuvenation, and, although only a short time passed after the first report, we have at the present time, quite interesting material on the question. We shall first point out the verification of Steinach's experiments on rats. This was undertaken by Romeis, one of the ideal opponents of Steinach. The experimental material was quite small (only one rat twenty-four months old) and of course, does not allow any conclusive deductions. Nevertheless, we consider it indispensable to quote Romeis' results. He did not obtain rejuvenation. Not even an increase in the sexual tendency could be noted in the operated rat. Hystologically, he was also unable to disclose any of the alterations described by Steinach, such as, the increase in growth of the Leydig's cells. However, in accordance with Steinach's data, Romeis could establish an increase in appetite and weight, from 160 gms., Nov. 30, 1920 to 215 gms., January 6, 1921. Furthermore, on the bald places there appeared new growths of hair. The increase of weight however, was not maintained for any length of time and soon fell to 180 gms., and remained at this height.

The changes that followed, Romeis explains, were due, not to the influence of the growing gland of maturity, but to the absorption of the products of internal secretion and disintegrated reproductive cells of the transplanted gland. The increase in the size of the testicles noted by Steinach was also confirmed by Romeis after the operation, but he considered it purely accidental.

About Romeis' experiments, the following may be stated; first, there is only one instance and therefore cannot be compared, either in the execution of the technique or in its significance with the numerous experiments performed by Steinach since 1910. Second, in Romeis' experiments there are indications that the test was not accurately performed, the very fact of the accumulation of fluid in the transplanted gland which Steinach never

noticed and WHICH SHOULD NOT HAVE HAPPENED, indicates that there was something wrong with the experiment.

We are not inclined to consider Romeis' experiment of any marked significance, deeming it not entirely blameless and therefore, hardly convincing.

Regarding other tests on animals, we should mention the interesting experiments performed by Harms on dogs. One case is particularly worth describing. In 1920 he performed an operation for rejuvenation by transplanting sexual glands in a dog which had not been pregnant since 1916. A short time after the operation, there appeared the first somewhat weak signs of rejuvenation. In December 1920, the animal became pregnant. To his regret, the pregnancy terminated in a miscarriage.

The hairy covering of the animal, which betrayed before the operation a marked deficiency, soon became entirely normal and thick.

In this test of Harms, we have before us a phenomenon quite similar to the experiments of Steinach himself, where an entirely impotent female became pregnant soon after the operation for rejuvenation. Similar results were obtained by Voronof in Paris in his experiments on old goats and sheep, and Wilhelm in Chili--on old bulls and dogs. Wilhelm worked not only according to the method of transplantation, but also employed the technique of ligation the outlet of the testicles. However, of greater significance for quite apparent reasons, and the results obtained on human beings, are attracting general attention. These, naturally, are more numerous and we can say that, as a whole, they appear quite successful. Besides Lichtenstern's cases, there have been published about three hundred cases of investigators, such as P. Schmidt, H. Benjamin, Sand an numerous others.

Comparatively big is the material of Schmidt. The results he obtained are, for the most part, very successful. In view of the fact that they entirely coincide with those of Lichtenstern's, their description would only lead to

repetition. We shall merely note that most pronounced changes which appeared as a result of the operation. These are: increase in weight, change of blood pressure, a stronger growth of hair, improvement of vision, disappearance of tremor, increase of working capacity, the restoring of the lost sexual functions, an improvement in general well being, a better and a regenerated memory.

In many instances, the action of the operation remains in its full strength for over three years. In some cases constant improvement is still evident. The influence of auto-suggestion, was entirely excluded, for the patients had no idea as to the character of the operation to be undertaken. The author could not find any harmful results following the operation, during the entire period of his observations. I, personally, have seen a series of patients, who had been operated on by Schmidt, and who were inspected by the International Congress of Sexual Biology in Berlin. Although, it is difficult to form any opinion, not knowing the details of the condition of the patients after the operation, we must admit that the results were quite hopeful.

In Benjamin's cases the operation re-established the sense of hearing in one, and vision in another patient. A similar observation was made by Heimann?

An extremely striking case was reported by Kramer. He operated on a fifty-nine year old melancholic. For many years the patient was suffering from enlargement of the prostrate and from impotence. The urine contained sugar. Medication was entirely useless. On January 10, 1921, Kramer performed on him a Steinach operation. At the beginning no changes could be noticed, but about two months after the operation a decided improvement suddenly appeared. He showed a marked interest in his surroundings, his frame of mind has improved, appetite increased, sleep was restored and his general appearance becam healthy and lively. The patient gained seven and one half pounds in weight. His sexual desires reappeared. The urine was free from sugar.

The author considers the operation as the cause of all these improvements. Finally, we shall mention the experiments of Loewy and Zondeck, who could establish, as a result of the operation, an increase in the interchanges of gases. These tests are extremely important because they demonstrate, not only external changes of the organism, but the action of Steinach's operation on cellular activity.

In the large number; over three hundred successful cases mentioned before, the few unsuccessful cases reported by individual authors, are entirely lost.

However, a fatal case , as a result of the operation, is reported by Mendel. Although this instance is unique, we find it necessary to consider it, in view of the serious consequences that followed. No matter how we wish to view Steinach's operation, Mendel's fatality must be very instructive and important.

The case in question concerns a sixty-one year old merchant, who came to Mendel in January, 1920. The patient came from a healthy family and had been married twenty-two years. He was childless, had always possessed a calm but lively temperament, lived moderately in general, as well as in his sexual relations, had never suffered from any venereal disease, was very limited in the use of alcohol and smoked considerably. About 1917, the patient began to suffer from headaches, his memory became weak, and his frame of mind became depressed and irritable. His desire for work and pleasures was lost, he slept little, his sexual desires and potency had notably diminished.

General examination disclosed only a slight degree of arterio-sclerosis, corresponding to the age of the patient. Otherwise, his condition was quite satisfactory. The internal organs appeared normal, the urine was the same. Mentally the patient gave the impression of a prematurely aged subject; his motions as well as thinking capacity and his actions were very slow, his psychic condition corresponded to a normal individual about seventy years

old. A variable course of treatment was applied, but everything proved to be futile. The patient presented a typical picture of senium praecox (early senility).

At that time, Lichtenstern's works appeared with the report of the favorable results of Steinach's operations in cases of premature old age. Mendel proposed this operation to his patient. The latter agreed. October 25, 1920, Dr. Schlesinger performed the operation under local anaesthesia, following strictly all the rules pointed out by Steinach and Lichtenstern.

On the following night, after the operation, the patient became very excited. On the second day he became considerably apathetic and although entirely calm before the operation, began to run around the room, rudely cursing the physicians and the rest of the personel. During the days that followed, the patient became calmer. The wound healed well and quickly. Nevertheless, he showed a series of psychical disturbances, which were expressed in the following: In the lost power of orientation as to time and space, his loss of memory, sleeplessness and restlessness; erections became more frequent, right after the operation, but soon disappeared. The patient became very obstinate, careless and completely helpless. Nevertheless, the deeper changes were more related to his mentality. The patient, who was before the operation, even-tempered sexually, became entirely absorbed in the latter. He began to use the most vulgar expressions, which his wife had never before heard him utter. At one time, he insisted that his wife was a street woman, who lured him into her room; at another time he would refer to his own dwelling, as a house of prostitution, and his wife--the woman in charge; would not allow her to touch him, declared that he would not be in the same bed with her, that she accepted others, etc. At another time he would become very jealous of his wife, and would accuse her of being untrue to him. During the following weeks his condition became worse, his restlessness and delirium increased and it became necessary to transfer

him into an insane asylum. This took place January 18, three months after the operation. About the end of January the patient quietened down and finally sank into a state of complete apathy and drowsiness, refused food and February 6, 1921, died as a result of respiratory paralysis.

Such is Mendel's case. Although, it is up till now, unique in literature, and does not make up one percent of the published observations, it, nevertheless, deserves a very serious consideration for, according to all the data established by Steinach and Lichtenstern, this patient was ideal for the operation. There were no contra-indications found, the organism, in general, was healthy, the heart, the lungs, the kidneys, were found to be in good condition. Syphilis, tuberculosis and new growths were excluded. As regards the arterio-sclerotic changes, it may be said that they were negligible.

And so we have before us a typical case of premature senility, without any expressed organic difficulties and most satisfactory for Steinach's operation. As a result, what do we see? A very severe psychosis leading to death, with a very excited sexual delirium, completely foreign to the previous conditions of the patient, leading finally to the fatal outcome.

Naturally, it would be unjust to consider the operation as the cause of death of the patient. Taking into consideration the changes in the patient's blood vessels (arterio-sclerosis) about whose degree of development, Mendel tells us very little, we may easily perceive that this accident was only a coincidence. However, if we should take the view that this fatal outcome was a result of the operation, then we must consider the fact, that in the above mentioned case, the surgeon committed a very grave mistake. The point is this: that in Mendel's patient there were ligated, not one outlet, as is usually done, but both outlets at the same time. In other words, in one procedure, there was performed the strongest possible surgical interference. In view of the patients sclerosed

condition of the arteries, such a strong stimulant, introduced by the operation, appeared quite risky and could lead to such fatal consequences as appeared in Mendel's case. A less strong interference, such as the ligation of only one outlet, could not have entailed similar consequences. Whatever it was, the published case of Mendel three years ago remained, up till now, unique and in spite of that, the number of operations reached a large amount and if at the time of that report, this fatal outcome made up two percent of all the known cases, it is now only one third percent. The latter circumstance, apparently speaks in favor of this supposition: that the unfortunate outcome of Mendel's test, must have been an accidental coincidence. It is hardly just to pick out this particular fatal case from a great number of successful operations. Just as the successful cases should not make us extremely optimistic on account of the meagerness of observations and the necessity of further careful verification and investigation, so Mendel's case, for the same reasons, must not lead us to the extreme of a depressing pessimism. The method is too new, the data too scanty, to enable us to estimate immediately the pros and cons of the operation and establish definitely the real causes of the resulting changes. Ceaseless, tireless, careful work will finally throw a better light on the still vague problems, whose solution is sought so bravely by the famous physiologist.

But what does Mendel himself think about this case? What does Steinach think about similar instances? They both treat the subject correctly along the lines developed above.

"It would be extremely wrong", says Mendel, "on the basis of only one reported case, to express a disapproval of Steinach's operation. It is necessary, in the future to pick these cases for the operation, with the greatest of care and to treat them less optimistically and consider possibilities of failure. Opposition in general", continues Mendel, "is entirely non-productive. He who confirms, and not he who opposes, is creating life".

It is interesting to note, that approximately the same thoughts were expressed by Steinach.

"Of course, there will be unsuccessful cases," he states, "but they appear to me just as valuable and instructive as the successful ones. Only, in this manner, do we learn to distinguish the alterations in the organism, which follow the beneficial action of the operation, from the disturbances, which have an entirely unknown source. We learn to judge better the indications for the operation and note with more exactness the limits of the influence which may be exercised on the organism by the regeneration of the internal secretion of the sexual glands". "It is self-understood, that the problem demands further investigation", continues Steinach. "A thoughtless, probably convenient, but entirely fruitless criticism will not have any influence on its further development."

In closing the analysis of the criticism, dealing with Steinach's works of rejuvenation, we shall also point out that there was no scarcity in objections of an unethical character. Thus Professor Alfred Kohn, considering the revival of the sexual function in operated old men, with all its consequences, expresses himself against "the ressurection of the abnormal, sexual, coveting old age."

Regarding this, the following may be stated. As we have already seen, the revival of these sexual functions is only one of the numerous influences on the senile organism exerted by Steinach's operation. Of course, if the many sided beneficial phases of the operation are established, then it is understood, that one will hardly wish to reject all the other rejuvenating qualities of the operation on account of the increase of the sexual function.

Besides, we must confess that this objection cannot interest us in this case, because it is directed, not against the operation itself, but against one of its results. The point in question is the scientific aspect of the operation and not its moral. In this respect, the achievements of medicine and science in general must be separated from morals. Science must be entirely free from any motives

or tendencies. The process of scientific creation is a purpose in itself, as such, without any additional coloring. That is all that interests the investigator. The application of scientific attainment to our every-day manifestations is an entirely different question, which goes beyond the limit of the research laboratories.

Such are, in general outlines, the objections made against Steinach's operation. We could quote a still greater number but the analysis of the above mentioned shows how sound is the basis of Steinach's experiments, how deeply they were planned, how carefully they were executed, and with what care they were protected from possible attacks. With the objections quoted, we have exhausted everything in the line of criticism of the practical significance of Steinach's operation. All the other objections have a greater or lesser theoretical interest, leaving out entirely the practical side of the question. For instance, some investigators recognize the interno-secretory activity of the sexual glands and their specific role in the development of the organism, nevertheless, they deny the existance of an independent gland of maturity. They suppose that the sexual hormones are produced, not in the special interstitial cells, but in the reproductive elements of the gland. (Harms, Romeis, Stieve, Benda, etc). The authors of these views explain the effect of Steinach's operation from their own standpoint. The fact is, they say, that the reproductive part of the gland after the operation, as the hystological investigations show, is not entirely destroyed but suffering a temporary retrograde degeneration. At the end, however, as Steinach himself recognizes, it is regenerated again. That means that the reproductive gland and not the interstitial, may be considered as the cause of the alterations appearing in the organism after the operation. This improvement in the general condition, following the operation, at the time when the reproductive part of the gland is in a state of considerable degeneration, is in the opinion of these investigators, püite a natural occurrence, because it showed that a

greater or lesser quantity of functioning tissue in the hormone--producing system is of very little significance. Furthermore, these sudden improvements following the operation, may also be explained by the fact, that the abundant quantity of seminal fluid accumulating in the canals as a result of the ligation of the outlet and the removal of normal escape, is rapidly absorbed by the blood and in this manner, exercises a rejuvenating action on the entire organism. Thus the cause of the effect of the operation appears to be, not the increased action of the interstitial gland, as Steinach thinks, but the absorption of the reproductive elements. The quoted objection shows clearly, that in science, the very same fact may be interpreted in a number of different ways, and may serve as a basis for two opposing hypothesis.

We shall show, that the suppositions expressed by these authors, may not be entirely opposed to the problem in question. According to their views, the internal secretion must be ascribed to the entire sexual gland and not to any particular part. Personally in considering the internal secretion of Leydig's cells, after the tests of Steinach and his co-workers have been proved beyond contradiction, we still are inclined to ascribe to the reproductive part of the sexual gland, the role of an activator, transforming the hormones of the interstitial gland into an active condition.

Nevertheless, we must remember that this argument holds an interest purely theoretical. Future investigations, based on the application of an improved technique, will explain the true conditions, reveal the true nature of things and show who is right and who is wrong. It is important that the interno-secretion of the sexual gland, exists and that the contributed hormones are able to produce the deepest alterations in the organism, both physical as well as mental. Furthermore, although we have no conception of the nature of these hormones, we have nevertheless, learned to use them involuntarily, directing the vital processes of the organism in the desired direc-

tion. We have changed a female into a male and the signs of senility into characteristic attributes of youth. The importance of the theoretical dispute as to what particular part of the sexual gland is concerned is now secondary in importance to the interno-secretory function, since its character is purely abstract.

There is a great deal of work ahead, many questions demand answers, and many enigmatic manifestations call for an explanation. But life, as a rule, does not and cannot wait. The questions which today interest us most are these: What practical deductions must one make from Steinach's achievements and his data? What do Steinach's works offer us in the future? What is the danger of this operation? When is this operation contra-indicated?

CHAPTER XI

THE PRACTICAL SIGNIFICANCE OF STEINACH'S OPERATION, DEDUCTIONS AND PERSPECTIVES.

Reviewing two years after their publication the data to which the criticism of Steinach's works has led us, and after considering all the arguments pro and con, we must admit that the basic scientific principles attained by Steinach on animals, are firmly established. Undoubtedly, as a result of Steinach's operation on the old rats, there appears in their organism deep and quite complicated alterations which we justly characterized as a rejuvenation. The question about the prolongation of the life of the operated animals as well, we must answer in a positive sense. From the practical standpoint, however, we are chiefly interested in the forms of this operation in man. It is self-evident, however, that there arises here quite a complicated and difficult question about the possibility of attaining in human beings the results obtained by Steinach on rats.

The scientific world experienced so many bitter disappointments in relation to rejuvenation, that an extremely careful verification of results and further investigation of this work is quite necessary. At the same time we must oppose every attempt of unfounded scepticism and objection, especially when they are made in the face of numerous experiments and clinical data, which definitely show that these tests are applicable to the human organism. In substance, we should remember, that the general and biological laws of development in the animal kingdom, are quite similar. Frequently, the cause of failure and disappointment is not due to the fact that the result

of the laboratory experiment cannot be applied clinically, but to the lack of our own knowledge, and particularly the failure to discount some important factor. Usually, the fault lies with the investigator, who has lost sight of something or has failed to take into consideration factors that might play an important role. If, however, they are carefully considered, failure is impossible and the results obtained in the laboratory agree with the data in the clinic.

In Steinach's tests, it is understood that we cannot anticipate identically the same results from an animal as from a man. Undoubtedly, everything speaks in favor of Steinach's experiments. In general, the internal secretions, which are the basis of Steinach's works, are similar in various animals. Adrenalin, the hormone of the suprarenal glands, manifests its action independent of its origin and is the same in various animals. The results, after the disappearance of a given hormone are identical among the different representatives of the animal kingdom. The absence of the hormone of the thyroid gland, for example, causes the universal complications. Myxedema, one of the chief physical manifestations, after the disappearance of this hormone, arises in man as well as in animals and will give way to treatment by the same hormones. The pituitary body has the same action on the process of growth, both among animals and man. Finally, the very internal secretion of the sexual glands, exerting its specific influence on the physical and psychical world and especially on the development of the secondary sexual characteristics, manifests its powerful effect on human beings in the same manner as it does on animals. All this shows that the deep biological changes which appear as a result of the regeneration of the interno-secretory function of the sexual glands, characterized by Steinach as rejuvenation may be justly expected to take place in man under the influence of the same factors.

Thus, the deductions made by Steinach about the pos-

sibility of transferring the results obtained in the laboratory into the clinic appear quite logical. We only have to take into consideration that in the development of senility in man, factors enter which take no part in the development of old age in the rats. These factors may give a different result among men than is obtained among animals. What are these factors? They are fairly numerous and consist of the following: As we ascend the zoological ladder, we meet in the animal kingdom a gradually more complicated organization and with it a greater variation exerted by physical and psychical influences, which play an important role in the normal cycle of all the vital processes. Therefore, the greater the degree of differentiation from one animal to the other, the more distinct will be the characteristic cycle of these vital processes, and especially in relation to the development of old age. The more these animals preserve their common traits of their constitution and biological reactions, the more precisely will they react towards the same biological agent and the more we can judge them in such cases by their analogy. This judgment by analogy is particularly feasible in closely related species of animals. That is why particular interest for man is found in experiments on monkeys. The further the animals are away from each other on the zoological ladder, the more difficult it is to make deductions by their analogy. Nevertheless, we have seen that in the domain of internal secretion we find in this sense particularly favorable relation.

However, all the factors determining human senility are not exhausted with the question of internal secretion alone. The more complicated the structure of the organism, the richer is the psychic life of the animal. This is the chief factor, which must be taken into consideration when comparing the development of old age between man and the rat. How does this factor express its influence? To what extent may the consequences of its influence be removed by operation? To what extent does the very factor of the mentality of man change as a

result of the operation? All these are questions which demand prolonged further experiments and investigations. Only an abundance of operated material is capable of answering all these questions and not speculative theories or suppositions.

What is this material giving us? What is the deduction from all the approximately three hundred cases of Steinach's operations on man so far now reported?

We have seen that an enormous majority appear quite favorable and hopeful and from this standpoint invite further investigation. As early as two years ago, the future of Steinach's operation was enveloped in a thick cloud of uncertainty, which only lately is beginning to clear. For, at that time, all the favorable cases reported belonged to Steinach himself and his co-workers.

There were available no other authors with any other material. Now, however, matters have changed. The number of performed operations has increased to about double and at least one half of all the known operations belonged to other surgeons, who cannot be accused of any partiality. The results obtained by these investigators are recognized as quite favorable and to a certain extent identical with the data reported by Lichtenstern. These were a series of these cases under our own observation in which we could definitely establish the beneficial action of the operation. It is true, single cases were unsuccessful and one case (Mendel's) even fatal. However, even if we consider the operation the direct cause of the fatality, nevertheless, we must recognize the fact that the percentage of success is overwhelming. From this standpoint, Steinach's method may compete even with any known surgical procedure which has been employed in medicine for a longer time.

Of course, the significance of even one unsuccessful case should not be lessened. It should constantly serve us as a reminder that our knowledge about the problem touched upon by Steinach, is quite insufficient, that we should withhold any positive statement and always aim

for further data on the basis of definite work accomplished.

The question as to the possibilities of transferring the results of Steinach's experiments from animals to man, may be answered thus. Apparently, this can be done with certain limitations, according to the degree of influence on human old age of those particular factors, which are absent in the animals. Of quite an importance, both scientific as well as practical, is this compiete analogy in the changes which appear as a result of the operation in animals and in man. By comparing the pictures of alterations in the rejuvenated animals and the results of the operation in man, we find that we can establish a striking similarity and in many instances even find them identical. These observed similarities are, therefore, quite indicative and hopeful.

It is a great deal more difficult to answer the second question. Does the rejuvenation in man influence his longevity as it was established in rats? In the animals the question of longevity, as a result of the operation, could be more easily solved, because the general duration of life of these animals is short, an average of twenty-seven to thirty months. As we already know, Steinach succeeded in prolonging the life of an operated rat for about eight months and by repeated operations as much as twelve months. In man however, a quarter of normal life corresponds to about twenty years, a period thirty times as long in the case of the rats. It is hazardous here to make any conclusions by analogy for the very fact, that if the action of the operation could continue in an old organism for eight months, it does not necessarily follow that it may do the same for twenty years. Only prolonged observations may solve this question and we shall have to wait patiently before we can make any definite conclusions about it. So far our direct observations on man are only about four years, a period, of course, entirely insufficient to judge the possibilities of prolonging his actual life by means of Steinach's operation. One thing we

can state; that the few years of observation hold definite hope and the established beneficial changes after the operation, according to the data of various authors, have strongly encouraged our expectations.

So far, regarding the second question, we are unable to give any direct conclusive answer at the present time. All we can say is, that the results obtained up till now, encourage further investigation. A complete solution of this problem belongs to the future.

The next question of importance, is the danger of the operation. May one undertake it without any particular risk?

From the previous arguments it follows, that Steinach's operation is too young to give at the present time a definite answer. However, we should not exaggerate the uncertainty and fears. The three hundred cases known at the present (about half of which belong to Steinach's School) undoubtedly speaks in favor of the operation. Besides, the two cases previously mentioned, are still in a state of rejuvenation. It is difficult to foresee any danger in the operation, if it is performed technically correct and, if it is carried out in the proper order of sequence (tieing off one duct at a time). Of course failures cannot be excluded and there is a great deal for us to learn. We cannot, however, lose sight of the following fact, which is very characteristic of the psychology of scientific discoveries and the masses in general. Steinach's method is new and in order that it should be fully recognized, there is demanded at the beginning a guarantee of complete safety and absolute success. Even in individual failures, the method is subjected to merciless criticism with explanations of its futilities. Only after a long time, after the method has succeeded in taking actual root and establishing for itself a place among other means employed by practical medicine, only then, in spite of all the obstacles, will it be treated comparatively favorably, notwithstanding even frequent failures. This is undoubtedly an injustice, but to our regret, it is an inevitable psycho-

logical fact. To fight it is difficult. But our problem seems in its practical application more difficult than was anticipated. The unfortunate part is, that practical methods of medicine are usually discussed, not by well trained minds, but by a semi-scientific crowd, entirely strange to a strictly analytical manner of thinking. In the estimation of scientific phenomena these pseudo-scientists approach the problem from purely everyday point of view committing numerous mistakes. That is why time alone will combat scepticism based mostly on profanity as well as on ignorance of the relation of scientific discoveries. Only when the method has succeeded in penetrating the mind of the scientists, will the general relation be altered. This same ignorant scepticism confronted all the other important scientific discoveries. Only proper discipline of mind may overcome this pitiful manifestation. Even at the present, there can be noticed a more sensible relation and the problem again enters into its normal course of further development, from which it was thrown out about four years ago by undue attacks and severe criticism It is beyond doubt that, as the years pass, the importance of Steinach's discoveries will occupy a deserving place with other high scientific achievements, which found an application in practical life. It is clear that Steinach's operation is not a miracle, but a scientific method with all its strong and weak points, with successes and failures, with splendid results and fatal consequences. Only further tireless work, only a constant movement forward, only definite creation and not fruitless criticism can remove the deficiency of the method, changing it into a powerful force for the improvement of our individual life.

We should always remember that in contemporary science in general and in practical medicine especially, there is no method, which guarantees absolute success and complete safety. The cases that come under treatment, are too individualistic for this method to meet with universal and absolute success. But for some reason or other, a guarantee is demanded, particularly from new

methods, and probably for the same reason all those methods that have taken root are liberated from such requirements.

For fourteen years has Erlich's six hundred and six been employed. There can hardly be found a physician at the present time who could get along without the use of this drug in the treatment of syphilis. Nevertheless, how much doubt was evoked by Erlich's preparation! Who can say even now, with full confidence, that six hundred and six will bring a cure in all cases? And what about the fateful consequences in the application of Salvarsan? Yet, all continue and will continue in the future to employ it. On the basis of enormous practical material and clinical observations we still see in Salvarsan a powerful means in the struggle with syphilis. We may make mistakes. Our mistakes may sometimes be fatal, still we continue on the chosen path. Only in this manner can we attain anything. Only in this way can we learn to distinguish strictly successful cases from failures and discover the cause of the latter.

There is no such thing as absolutely irreproachable, absolutely successful and entirely safe methods nevertheless, we continue to employ the knowledge obtained. Only in this manner can we progress, otherwise we would never learn anything, but would be lost in conjectures and would remain stationary. Life does not wait. We know that mistakes are possible, that they are frequently inevitable, but only through them could we move forward. Only in this manner can we get glimpses at the truth, but, which like every other high ideal we may never attain. We do not have in our possession absolute means. We are not gods and we do not have any sorcerous elixirs and, therefore, they cannot be expected of us. All these thoughts should not be forgotten, especially when we consider the fact that this method firmly established on a scientific foundation, was created after long years of laboratory research. Steinach's methods promise us a great deal, but we cannot demand from them ab-

solute guarantees always and in all cases any more than from the other older methods, tried for a longer time. One thing may definitely be stated. In the essence of its practicability and safety, Steinach's operation may compete with the majority of other methods now employed in medicine. The rest, the future will show.

But, may everyone subject himself to this operation for rejuvenation? Is it always applicable? Are there cases when it is better not to have recourse to this operation? Are there cases, in which Steinach's operation should have been forbidden? These are the questions which persistently demand an answer. The material now on hand gives us the right to make a series of interesting conclusions.

First, the operation should not be undertaken too early, when the sexual reproductive function is in full bloom. In this condition, the sudden exclusion of the activity of the reproductive part of the gland may reflect quite stormily and severely on the general condition of the organism and result in a series of sever disturbances, both physical and psychical. Such disturbances were frequently observed in the past when the ligation of the outlets of the sexual glands were undertaken for the hypertrophy of the prostate. In order to avoid a too sudden exclusion of the reproductive function of the sexual glands, it is recommended to perform the tieing on one side only and then on the other.

Second, we can readily surmise, that the operation will be successful, only in the case where the senile alterations of the organism, do not depend on some severe illness, such as tuberculosis or syphilis. In these cases the treatment of the fundamental suffering will be much more effective than any operation for rejuvenation.

Moreover, in many diseased conditions, particularly where the heart is involved, the operation must be recognized as entirely contra-indicated and should be forbidden. Only those prematurely aged who posses a generally healthy organism, can be recognized as suitable

Illustration No. 32.

Masculine female.

The famous artist Rose Bonheur.

Illustration No. 33.

Masculine female.

Anna P., who has been living for quite a few years as a man.

subjects for the operation. Those physicians who fail to remember this part may spoil the reputation of the method by chosing the wrong patients. Quite frequently and readily we throw the burden of responsibility on the method employed in case of failure, when the real source of it lies in our own errors. It would have been quite difficult to make a correct conclusion about the usefulness of Steinach's method, if one should chose for his subject a prematurely aged syphilitic, or one dying from tuberculosis. The treatment of the primary disease is of chief importance in such cases.

Moreover, in cases of progressive tuberculosis, Steinach's operation could bring a great deal of harm. The fact remains, that between tuberculosis and sexual activity, there exists a close relation in this sense, that the increase of sexual functions heightens the virulence of the tubercular infection. The tubercular virus is apparently, stimulated by excessive sexual indulgences. In favor of this view speaks the fact noted by Mautner. According to the latter, castrated rabbits stand tuberculosis a great deal better than the uncastrated animals. Mautner could further note that the animals with the ligated outlets of the sexual gland were more readily subjected to tubercular infection. As an illustration of the second supposition, we may quote the well known fact that tubercular patients quite frequently show a strong sexual tendency and the prognosis in these cases, is as a whole better when the sexual activity is less. In this respect, a striking incident was observed by Schmidt. He reports that a patient has completely recovered from a very severe tubercular process, affecting both lungs to such an extent that his entire chest seemed deformed. Nevertheless, the patient emerged from this quite successfully. Under examination was disclosed a very marked natural underdevelopment of his sexual glands and external genitalia. His voice was high pitched and reminded one of the voice of a castrate. Guided by these investigations, Schmidt supposes that the cause of the recovery of this patient was

the underdevelopment of his sexual glands. The above mentioned case, by the way, opens new perspectives in the treatment of rapidly progressing cases, of tuberculosis, where at least a partial castration might be tried, especially should the sexual condition of the patient point to it.

Another important contra-indication for Steinach's operation is a highly increased blood pressure. This circumstance will not surprise us, if we consider that the regeneration of the internal secretion of the sexual organs, acts excitingly on the functions of these suprarenal glands producing the adrenalin. The rapid entrance into the blood of the latter in large quantities will increase the blood pressure considerably. That is why in such cases we must practice extreme carefulness. An attempt is made to reduce the blood pressure for the time being by means of medication. The operation is then performed on only one side and the ties applied some distance from the testicle. In this manner the action will be delayed and later the other outlet may be tied off. If we should exclude all cases of heart disease, high blood pressure and finally a progressive tubercular infection, then we cannot establish any other contra-indication at the present time for Steinach's operation. This has a particular significance; for the practical tests, which have now reached enormous proportions, do not give us any reason for any other contra-indications. On the contrary, as far as it can be established by the observations, the operation is not followed by any injurious consequences to the organism. This is unanimously confirmed by the majority of investigators, who have employed Steinach's operations. No ill effect could be noticed by the author of these lines, who had a series of patients submitted to Steinach's operation. It is true, he could not find all these striking effects, which are reported by some other authors. Nevertheless, there appeared, undoubtedly, a series of general improvements, such as an increase in weight, im-

provement of appetite, a better working capacity and the re-establishment of the sexual function, in some cases for a considerable length of time. Besides, we should emphasize the fact that not all cases are adapted for the operation from the biological standpoint. As an example, I wish to quote an incident under my observation. The patient was a prematurely aged lawyer, forty-six years old. He gave a history of an old veneral disease, sexual potency was markedly weakened. Outside of that, the patient's condition did not disclose anything abnormal, except that he was very gray and had a slight arterio-sclerosis. According to his appearance he could be given about sixty years. This was particularly interesting, because he reminded one of the first case reported by Steinach and Lichtenstern. During an operation for hydrosele, the outlet of the affected testicle was tied off. As a result there appeared after the operation, some improvement in the general well-being of the patient, a better appetite, increased sexual function but only for a short time. Three months after the operation the above mentioned improvements began to disappear and the previous condition was re-established. However, too much stress cannot be placed on this instance, as the testicle was in a diseased condition before the operation and its interno-secretory ability is questionable. The author expressed the same fears at the very outset and experiences showed that they were not without foundation. Nevertheless, judging from the observation of numerous cases, I can state definitely, that there was no undesirable effects after the operation.

These are shortly outlined, practical conclusions which may be made about the applicability of Steinach's operation at present. A great deal is promised by the development of the method of transplanting into old animals the sexual glands of younger ones, particularly with the combinations of other glands. At the present time, this method meets with considerable technical difficulties. According to the general biological law governing the

transplantation of tissues and organs, the latter grow better in cases, where they belong to the same family. Comparatively as well, will the organs and tissues take root even in related animals. The same tissues grow considerably worse in animals of different species. Here again, are noticed the close differences between the success of the transplantation and the degree of relationship of the corresponding type of animals. The transplantation of organs of various species, far apart on the zoological ladder, is so far, entirely unsuccessful. Transferring these data to man, we may expect more sensitive and satisfactory results from the transplantation of glands from near relatives or from healthy people in general. As to the transplantation of organs from other animals, they should be obtained from human-like apes. Of course, it is quite difficult to have sufficient human material for transplantation, because there can hardly be found anyone who would sacrifice it voluntarily. Still more cautiously must we therefore, handle this limited amount of material, which accidently falls into the hands of the surgeon, in such cases for example, when the sexual gland must be removed from the organism on account of some anatomical misplacement. Lately, as a result of very important observations made on the basis of Steinach's works, an attempt was made to utilize by organized cooperation all the possible transplanting material that may come into the hands of the surgeon. In the German Medical Press a great deal of attention is devoted to this question. One of the sexual biologists in Berlin, A. Weil recently suggested the following proposition, that in all big centers, where there is a rich material of sexual glands, all the hospitals and surgeons should be in constant communication with their colleagues, who may be in need of the transplants. "Particularly in Berlin" says Weil, "such contact among the various clinics should be established immediately, in order that not even one sexual gland useful for transplantation may be lost in vain."

Of course, Weil has in view, not only the transplanta-

tion with the object of rejuvenation but also with the aim of removing consequences of castration, eunochoidism and also for the purpose of treatment of the sexual anomalies, especially homosexualism. We must admit that the plans proposed by Weil are not quite rational, but of absolute importance. With great satisfaction, I wish to state that these measures are employed in reality.

It is true, we meet here some quite unexpected difficulties, especially when we approach the question of voluntary sacrifice of this material. There is a conflict shown between the just demands of medicine on one hand, and its legal interpretation on the other. It is interesting to note, that two noted jurists of Berlin, when asked regarding this matter, came to diametrically opposite conclusions. The tendency of one opinion is, that voluntary sacrifice of organs of the body is, from the legal standpoint, quite permissible, for injury to the body done with the consent of the injured, excludes punishment. According to the other opinion, the procedure is criminal because there is removed even with the consent of the owner, a very important organ of the human body. The fact is that the remaining compensatory sexual gland cannot be taken into consideration legally, on account of the possibility of the latter becoming diseased or injured and this may inevitably lead to the loss of the reproductive ability. However, the transplants of a healthy normal gland, even with the consent of the donor is legally not quite free from objections. But, when a gland is to be removed on the advice of a physician, it is permissible to use it as a transplant. The right of ownership of the donor on the removed organ of his body, may be transferred, according to agreement to the other party, accepting this organ. According to law, ownership of any particular organ of the human body can be claimed only as long as this organ is connected with the body.

Finally, we should not lose sight of the fact that castration as such, is a very old procedure, employed by people in various instances with a very diverse objective.

This purely legal question that came up in connection with Steinach's achievements, we raised because it deserves a very careful consideration.

It is understood, that all these questions fall off, when other, but human material is employed. Besides in this field we are justified in expecting an unbounded improvement and better results in the future. For the basis of these expectations may serve the hopeful experiments of heteroplasty, undertaken for the last few years by Voronof in Paris, Stanley and Thoreck in the United States.

Finally, we must remember that parallel with the development of the surgical method of Steinach's works, scientific thought has been progressing for ages also in other directions, attempting to solve the problems connected with internal secretion without surgical interference, i. e., by introduction of the missing hormones from without. We have acquainted ourselves above, with the success which was obtained in the application of the hormones of the thyroid and the suprarenal glands, pituitary body, etc. We have seen, that in many instances with one injection of the corresponding extract containing the missing hormones, one may achieve the same results, as can be obtained by the operation for transplantation. This is particularly striking in the use of the thyroid gland where, by the introduction of the corresponding preparation we succeeded in the re-establishing the disturbed physical and psychical functions of the organism, caused by either the removal of the gland or by its decrease in function. It is true, such results may not be obtained with other glands. As regards the gonads, we had up till now, apparently very poor results with their extracts. This may be the fault of the method of preparation. It is beyond doubt, that the various hormones differ to a certain extent in their stability. We must admit, that the methods of obtaining them are still lacking in refinement and are in need of further improvement. We can hardly question the fact that the day will come when we will learn to obtain the hormones from the gonads as well as

we have learned to obtain the same substance from other glands. Then, of course, the problem of rejuvenation will introduce a new phase of development, for it will make the complicated procedure connected with transplantation of glands, as well as with the operation for the ligation of the ducts, entirely unnecessary. Even now, we have symptoms of such indications.

We have already mentioned that Hermann, in a purely bio-chemical way, by the introduction into the blood of very young rabbits, a substance prepared from the ovaries, has attained such a development of the female secretory characteristics as is found only in the grown up females and only then during the period of pregnancy. We have also seen that Hermann produced the same effect by the injection of this preparation into the previously castrated males. The action of the preparation was so pronounced that the developed breasts in such femininized males, produced milk like those of the pregnant females. Hermann's experiments are important, not only because they confirm Steinach's results with the transplantation of the glands, but because they give a new impulse in the direction of bio-chemical investigations of the interno-secretory process.

The enormous practical significance of the introduction into the organism of hormones, instead of the performance of a complicated operation and the tremendous valuation of this method over the operation, requires no explanation.

Finally, a great deal may be promised by the methods worked out by myself in obtaining the secretions in cultures.* The latter is very young, or to be more exact, is just taking form, but the prospects it opens may be immense.

There is a great deal of work ahead of us and a great deal of energy will be required before the problems

*N. E. Ishlondsky. Medical Review--1921-1923 reports to the society of Russian Physicians in Berlin November 26, 1920.

touched upon by Steinach will receive satisfactory solution. Reviewing the practical significance of Steinach's operation, we can say that in its entire magnitude, it belongs to the future. A great deal of technical perfection is wanting for this operation, a great deal of hope is opened by the method of culture of tissues. Lastly, quite fascinating, appears the changing of the operation, with biochemical means introducing the corresponding hormones in the same manner that was dreamt of by Brown Sequard.

CHAPTER XII

THE SIGNIFICANCE OF STEINACH'S WORKS AND BIO-SOCIOLOGY.

The review of the main stages in the development of Steinach's works has shown what a tremendous significance they have achieved for biology in general. An entire series of quite obscure and complicated problems was splendidly solved by his labors. The explanation of the sexual development of man and animals, the nature and origin of the secondary sexual characteristics, the true cause of the changes following castration as well as the means for removing them, the role and significance of the sexual glands in the psychical life of the organism, the voluntary change of sex in animals, the solution of the problem of homosexualism and hermaproditism and finally, the placing of the problem of artificial rejuvenation of an old organism on an experimental basis, these are the chief points of the splendid chain of Steinach's works that have created a new epoch in the history and development of general biology.

A new work carried out by Steinach and his co-workers, adds to the chain of his investigations, another link of an interesting and valuable achievement which may acquire an important significance for contemporary anthropology. In these works, Steinach could prove that an enormous influence is shown on the development of the glands of maturity and secondary sexual characteristics by the temperature of the environments, in which the animal was kept. In rats brought up during a prolonged time at a temperature of 25-30 degrees centigrade Steinach obtained such a development of the sexual glands that

the three months old animals resembled in this sense, grown males. The prostatic gland and the seminal canals were particularly large. In the females, the uterus and tubes were correspondingly pronounced. The reproductive ability appeared earlier than usual, and when kept at a maximum temperature of 25 degrees centigrade the fertility was increased. Hystological examination of the sexual glands disclosed that the generative part under the influence of a higher temperature, has not suffered any alterations But, the interstitial tissue has powerfully developed. They are similar to those glands that were treated by X-ray, transplantation, or where the outlet was tied off. These experiments throw a light on the influence, which the climate may have on the development of separate interno-secretory organs and especially on the sexual glands. The latter may in turn, account for the cause of the appearance in various races of an earlier or later sexual maturity and corresponding secondary sexual features. With these deductions of Steinach's ingenious experiments our daily observations fully agree. We note an earlier sexual maturity among the southern races, in contrast to the nothern inhabitants. Steinach's experiments open before us the mechanism of racial differentiations, whose source, apparently, lies in the various rhythms of action and various degrees of development of the "gland of maturity" under the influence of the corresponding climate.

Earlier or later sexual maturity among the various races is not the only thing that becomes clear in the light of Steinach's works. A series of many other features are attracting our attention, such as, certain proportions of the body, the length of the trunk and its relation to the length of its extremities, and the various peculiarities of the structure and shape of various bones. Moreover, the racial differences in the distribution and degree of development of the hair on the body, the size of the breasts, the degree of muscular development, all these are peculiarities which are under the direct powerful influ-

ence of the internal secretion of the sexual glands. If, on one hand, we should take into consideration Steinach's experiments with the castration and subsequent transplantation of sexual glands, the influence, as these tests have shown on the degree of development of the above mentioned features, and if on the other hand, we should examine more carefully the racial differences and their proportional relation to the body; hairy growth, musculature etc., it is difficult to escape the impression that the activity of the interno-secretory part of the sexual gland plays an important role in the origin of all these characteristics among the different races. Thus, for instance, the Australians and certain types of negroes possess a comparatively short trunk and long thin extremities. In this respect, they strikingly remind one of the body of eunochoids. On the contrary, the Mongolians and Eskimos differ, for they have a comparatively long trunk and short massive extremities. The same holds true regarding the growth of hair on the body. Different races disclose quite a marked distinction. The southern races, in general, possess a larger growth of hair than the northern and some tribes are entirely deprived of it, so that even the region of the genitals, arm pits and extremities remain free from hair. From the standpoint of Steinach's works, the above mentioned peculiarities of the various races receive a new explanation. They clearly demonstrate the enormous significance which his teaching may attain for contemporary and future anthropology.

But, even in our daily life these works assume an important interest and significance. They entirely change our basic conception of the nature and origin of many sexual anomalies. In connection with these, our fundamental relations towards these anomalies is entirely altered and the important social question about the punishing of an entire series of sexual offenses, arises in a completely different light. Having explained the true nature of many sexual anomalies, we should not send to prison those with a clear conscience who as patients are in need

of treatment. When discussing the homosexualist, we were convinced that by operation and subsequent treatment, we can achieve a great deal more towards the cure, than by severe punishment. Steinach's works show fully, that we cannot treat complicated biological phenomena with common deductions obtained on the street. Undoubtedly, there are in the basis of many sexual anomalies, deep biological changes of an interno-secretory and reflex character. It would be a serious mistake to consider these alterations from the common standpoint. A still greater error is the transfer of judgment on the above mentioned questions of enormous biological complication from competent society to persons, who are entirely unaquainted with the nature of the observed anomalies. In this respect, Magnus Herschfield is right, when he says that the day will come that judges for all these questions will be, not people picked accidently, but physicians, specialists in this field.

However, we must not go to the other extreme, remembering that we are dealing with an anomaly and should aim to treat it as such. Just because homosexualism has a deep biological basis, it does not necessarily follow that the patient is incurable. In my report to the First National Congress, in Berlin in 1921, I demonstrated the relative conception of a normal heterosexual and pathalogical homosexual constitution. I also pointed out a laboratory method, according to which the so called normal organism can be stimulated to homosexual tendencies and activities and vice-versa, the pathalogical homosexual constitution may be brought to a normal activity.*

We cannot dwell here any longer on the nature of many mysterious anomalies, such as homosexualism, fetischism, transvestitism, sadism, etc. Our aim was only to show how much the results of biological investigation will change the estimation of the problem of sexual anomalies,

*N. E. Ishlondsky, Das Problem der Liebe im Lichte der Experimentellen Biologie. Verlag von Julius Puttmann, Stuttgart 1922.

having an enormous significance both individually as well as socially.

The denoted exception from the normal is not the only thing that receives an explanation in Steinach's works. They give us the solution to one extremely important social problem, whose biological nature was not even suspected, being usually considered partly psychical and only partly social. I have in mind the frequently occurring appearance of masculine women (Fig. 32, 33) and feminine men (Fig. 34, 35). We have already seen that people may be arranged according to the degree of their masculinity and femininity, in one long row, whose extreme members will be clearly expressed men and women with a definite predominance of the corresponding secondary sexual characteristics. Between these extremes the members may be placed in intermediate degrees, according to the greater or lesser development of their sexual characteristics. We know that by transplanting into the castrated animals the male gland of maturity in given quantities Steinach could produce experimentally this series and demonstrate the theory which was expressed by the young philosopher, Arthur Weininger. This frequent occurrence in our daily life, with which every one of us has come in contact, now appears in an entirely new light.

However, more interesting and important than the sexual problem which has first received its strictly biological solution, thanks to Steinach's works, is the frequently arising question about female ingenuity and about a comparative estimation of masculine and feminine spiritual abilities. From the standpoint of the teaching of the secondary sexual characteristics so splendidly worked out by Steinach, this question receives a new and entirely unusual and unexpected illumination. The so called spiritual life of a human being does not represent anything unique or elementary. Psychology of man is composed of an enormous quantity of very different abilities, the development of each depending on some definite center in the brain. All these centers can be developed

in quite different degrees and consequently, may be just as valuable as the corresponding abilities of another individual. For this reason alone it appears impossible to compare the entire masculine apparatus with the feminine. At best, we can only compare separate components, but not the total of heterogeneous items. We may compare distinct elementary abilities, but not the general complex of all the abilities. Such a comparison of different elementary qualities of men and women, as we shall soon see, is quite difficult. According to Steinach's teaching, the entire physical and spiritual world, both of man and woman, is under the specific influence of corresponding sexual hormones, either directly or through action of the other interno-secretory organ. These sexual hormones manifest a powerful influence on the very diverse centers of our brain, exciting some and depressing others. The highest spiritual functions of the human being fall under the influence of these specific sexual hormones and by the differences of this influence of the male and female hormones on the central nervous system is explained the entire contrast in the psychological difference between male and female not only in the sexual sphere, but in all the other functions of the human brain. Consequently, the very question whether a man is spiritually higher than a woman loses every sense, because the abilities of man and woman are heterogeneous in character. The male and female psychology being different quantities, guided under the influence of their specific hormones in opposite directions and changed by these hormones qualitatively are entirely incomparable.

In order that genius may appear in any given domain, it is important that the corresponding center in the brain should be unusually developed. It is true, that by work and training one may achieve quite natural creative results, and may attain some development of the corresponding centers. But one cannot become a genius. The latter have a definite biological basis in the sense of a natural potentiality of corresponding region in the central

nervous system. Men and women equally may achieve genius, but only in the corresponding domains brought about by the influence of their sexual hormones, wherein the masculine and feminine hormones, as we have already seen, are quite frequently antagonistic to each other and exercise a diametrically opposite action on many features. It is clear that the woman, under the influence of her antagonistic hormones, discloses an incomparably weaker development in these abilities, which are peculiarly natural and characteristic of man. On the contrary, the woman is considerably superior to the man in the development of these particular faculties, which blossom under the influence of the female sexual hormones. From this standpoint, the conception of secondary sexual features must be considerably broadened and in general all the properties of the organism, both physical and psychical which are under the control of the specific sexual hormones, must be classed with the secondary sexual characteristics. It is beyond doubt that quite a number of the peculiarities of our nervous and psychical apparatus must be attributed to these secondary features.

Which then, of the spiritual capabilities of human beings should be classed as masculine or feminine secondary sexual characteristics? In other words, which of the spiritual abilities are most splendidly developed in males and which among the females? The question was raised by P. Mobins and I. I. Metchnikoff. The latter dwelled particularly on the question, why women did not produce noted composers? As it is known, the controversy about feminine genius has quite a history. Notwithstanding the zeal manifested by both the partisans and opponents of this question, it could not have been successfully solved with any scientific definiteness on account of the lack of knowledge of its biological basis. The supporters of the feminine genius continued to maintain that the reason a woman is lagging in spiritual development and that up till now has not produced any female genius is, because during thousands of years the woman has been in a spiritual

sub-servitude to man, entirely submerged in small affairs of housekeeping. She is either occupied exclusively with her motherly duties, or with an enormous quantity of other little cares of daily life. The opponents to this question, obstinately point to the fact that not only has woman produced no noted genius in either the domain of art or literature, but that even in music, where women have worked incomparatively longer than man, and which from time immemorial has been womans' privilege, the same holds true. Women may be very talented in playing, but do not disclose any creative power in music.

This would seem a weighty argument in the hands of the opponents to the "female genius". At any rate the supporters could not master any definite reply. However, this question receives an entirely unexpected solution, when placed by I. I. Metchnikoff, on a definite biological basis, considering it from the angle of the secondary sexual characteristics.

The conception of these secondary features is well known to the reader from the previous chapters. We shall add here, that in nature the secondary sexual characteristics are widely distributed and frequently reach an enormous variety in the form of their expression, as well as in the degree of their development. Thus among birds, one will frequently meet the most fascinating designs in the arrangements of their feathers, typical of only one sex. Among the butterflies there is the most beautiful display of color in the wings. These designs are usually the property of the males and serve them as a means of attracting the females. Odors released for the attraction of the opposite sex are used for similar purposes. Furthermore, there may be observed among birds and spiders a harmony of motion reminding one of our dances. Finally, certain sounds whose harmony influences the females and attracts them from a very far distance is also employed by the males. To this category of secondary sexual characteristics belongs the song of the nightingale.

Considering the last example as a secondary masculine

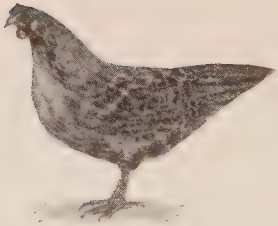
Illustration No. 34. and 35. (Feminine Male) Two poses of the Bararina King Ludorig II.
Feminine appearance in spite of military uniform Note the extreme femininity in this pose

a

x

b

y



c

z

Illustration No. 36.

A "feminated" rooster and a "masculinized" hen

a, b, c, Changes of the masculine characteristics of the rooster into feminine.

x, y, z, Changes of the feminine characteristics of the hen into masculine.

a. A normal rooster.
b. The same rooster after castration.
c. The same rooster after the transplantation of ovaries from a young hen.
x. A normal hen.
y. The same hen after castration.
z. The same hen after the transplantation of testicles from a rooster.

Note the striking similarity of b and y. In these tests of Zavodski, Steinach's experiments are finding a splendid confirmation.

sexual feature in the form of singing, Metchnikoff involuntarily transfers this on the analogical appearance among men. Also here, everything speaks in favor of the fact that the creative power of the harmony of sounds belongs to man, this being one of his secondary sexual characteristics, which develops under the action of his specific hormones. In the woman this feature cannot reach this phenomenal development as we find it in man. The result is that a woman may be able to play well, but she was not given the deep creative power of music. This is a definite masculine ability, a secondary sexual feature, and only in this manner can we explain the mysterious fact, why women have not as yet produced any genius as composers. However, if the man surpasses the woman in the domain of musical creation, then on the other hand, the woman possesses a series of numerous abilities, which, being under the influence of her specific exciting hormones, are her secondary sexual characteristics. With these abilities woman naturally surpasses man. One of them is memory (Ishlondsky). Women in general, possess an incomparably better memory than men. Moreover, in the development of memory in man, the sexual glands are of enormous functional significance. It is an undisputed fact that in the lower grades of school, the girls and boys manifest equally good memory. Beginning with the period of sexual maturity, when under the influence of the sexual hormones a series of physical signs suffer deep alterations, (such as the change of voice, appearance of hair on the face, etc.,) marked changes take place simultaneously in the psychology of the children. Particularly among the boys there is noticed a weakening of the mechanical memory and there appears a tendency to logical and methodical thinking. They remember only such things that are clearly connected with a deep logical thread. In the higher grades of school the inclination to this logical perception, instead of, so called mechanical memorizing, is manifested in its full extent. Apparently the beginning of the functioning masculine gland of ma-

turity hinders by the action of its hormones, the function of the centers of memory and stimulates the centers of logical perception. The man, as such, enters mature age. It is entirely different with girls. Both at school and after graduation they disclose a splendid mechanical memory, such as the ability to memorize long poems. But it is incomparably more difficult for them to solve mathematical problems and familiarize themselves with things which demand a logical reasoning. This characteristic memory of women, which I was able to establish beyond doubt during my school days, is perceived even at her mature age. Thus, according to my observations, women are splendid librarians, demonstrating a truly phenomenal ability in memorizing the largest catalogue. Recently I had an occasion to observe one such peculiar case in the Berlin Medical Library, where the librarian could almost unerringly tell whether a certain book had been returned or not. The cause is clear. The female sexual hormones do not depress as they do in man, the nerve centers controlling memory, but, on the contrary, they stimulate them and support their splendid development and vital activity for many years. But, these hormones do not exercise as they do in man, any stimulating influence on the centers of logical perception. This circumstance, as we shall see later, plays a capital role in the development of numerous peculiarities in the psychos of men and women.

From the above mentioned observations, I expressed an opinion* that among male homosexualists, in whom there is a supposedly abnormal production of female hormones, the memory must surpass those of normal males and vice-versa. In female homosexualists, under the influence of the abnormal masculine sexual hormones, memory must be below normal. Magnus Herschfield, who is considered an authority on homosexualism, on the basis

*N. E. Ishlondsky. In the discussion of the report of Dr. Magnus Hirschfield in the Institute for sexual wissenchaft, June 30, 1921.

of his extensive material of over twenty thousand cases could confirm my hypothesis definitely.

Thus, we have acquainted ourselves with two abilities, which may be classed in the category of secondary sexual characteristics, both in men and women. By this, of course, the spiritual world of human beings is decidedly not exhausted. The entire psychology of man, his method of thinking, his peculiarities of character, natural tendency, even his gait, his mimicry, his gesticulation, tone and temper, reasoning and deductions, all these are carrying the traces of the action of his sexual hormones. All these are, in one degree or another, his secondary sexual features. Similarly the entire psychological world of the woman, her peculiarities of temperament, her manner of expression, her chain of thoughts, all these are to a greater or lesser extent, female secondary sexual characteristics. In other words, the latter are under the control of her specific sexual hormones, entering through the circulation even the central nervous system and here exerting their powerful influence on the highest function of the human beings. In the first case, there is a strictly masculine logical manner of thinking, an order in his reasoning and exact causative connection between the precedence and the conclusion. This is undoubtedly a clear expressed secondary sexual feature. To perceive manifestations in any other but a logical manner is, according to his nature very strange to him, just as this particular logical perception of occurrences is unfamiliar to woman.*

Woman does not approach manifestations in the same manner. She does not guide herself in her deductions principally by logical methods and often perceives them

*This should not be misunderstood, that a woman is not deprived of the ability of logical reasoning nor does man possess no memory. The point in question is that these basic abilities in one case are stimulated and developed under the influence of specific hormones. In the other case they are hindered by the latter and therefore, do not reach this powerful development, which characterizes the opposite sex.

quite differently than would a male in her place. This specific perception of occurrences is immediate in character, something which is unknown to man. The conclusions at which a woman frequently arrives differ markedly in their logical sequence. This characteristic of immediate perception, which is partly understood as intuition, frequently allows the woman to say things, and to judge them in a manner which is entirely inaccessible to man with his "logical method of thinking" and seems to him equally illogical. The very thing which men call "feminine logic" is frequently nothing but this specific ability of woman to perceive manifestations differently than the male, thanks to the dissimilar construction of her thinking apparatus. This sharp difference in the character of perception between man and woman and in their estimation of surroundings, is shown in each step of our daily life. Even in their intimate relation, when man and woman apparently resemble each other even here, they preserve their specific estimation and characteristic relation to the surroundings. Woman perceives and estimates things differently than man, frequently finds beauty in places where the masculine psychos fails to see it. To explain this peculiarity of thought one has only to recollect the difference between how man loves and how love is expressed by a woman. Men and women understand and estimate love quite differently. Here, particularly, they manifest specific relation in connection with their sexual constitution, and their psychology carries definite traces of their physical organization, which is under the control and action of the sexual hormones.

Therefore, we see that the entire psychical world of man, his manner of thought and his abilities are to a certain degree his secondary sexual characteristics and differ markedly from the analogical abilities of women. In other words, we must recognize that at the time of maturity the sexual hormones exert on the somewhat neutral, and in many instances, similar psychology of men and women, a specific action strongly modifying the direction

of character, according to the nature of these hormones. That is why it is entirely incorrect to say, that spiritually, one sex surpasses the other. Some abilities, under the influence of the sexual hormones are better expressed in men--others in women. The creative power in music and a strictly logical characteristic to perceive manifestations, is the property of men. A considerably better memory and sharp intuition are the properties of women. These are only a few examples. Similarly, the rest of the entire spiritual world of all human beings may be divided into separate abilities, out of which some will be better expressed by men and others by women. That is why the difference in abilities between men and women are qualitative and not quantitative. It therefore, follows that the psychical world of men and women, consisting of heterogeneous quantities, are incomparable among themselves. Really, how can we compare masculine logic with feminine intuition? The latter frequently lead the woman to entirely different conclusions, than the man would make in similar cases: conclusions, which according to masculine terminology are frequently designated as absurd. But is it so in reality? Do we not frequently see how these "irrational" women may foresee occurrences, which men following their logical method of perception and estimation of manifestations are unable to foretell? In our daily life we say of such instances, that women reach conclusions by "feeling". This difference of perception is frequently met with in feminine life. How often will the mother surpass the father in his respect! With her "motherly feelings" she will notice a great deal in the life of her children at a time, when the "logical" father suspects nothing. I am dwelling purposely on this phenomenon of our daily life in order to demonstrate by a few everyday examples how far the biological method penetrates into our personal and social life, and how it alters entirely our daily conception of the nature of man. We may hope that the time is not far when every corner of our individual and social life will be enlightened by the

rays of biological analysis. Even now, the latter is acquiring a tremendous significance in the estimation of numerous complicated questions of our social life.

I have in mind the frequently arising uproar, creating the controversy of equal rights for women. A question which ceased to be the object of scientific arguments, and which became distressing in our real life, a question, which created in some countries an embittered political struggle, and yet has not, up till now obtained a solution based on a satisfactory biological argument. It would seem that a biological explanation is hardly possible, that this question is beyond the field of biologists, being the object of study for sociologists only. However, the fact is, that the latter ought to be in a certain degree, better biologists than they are in reality, because the solution of many social problems is utterly unattainable without the knowledge of biological facts and laws. One of the most striking examples confirming this view may serve the problem of equality of sex. Where then, is the biological basis of this problem? What can the sociologist borrow from the biologist in this respect?

The psychological world of men and women differs, not only quantitatively but also qualitatively. The physical constitution, as well as the entire mental sphere of women, being under the influence of her sexual hormones, sharply differs from that of men. This means that not all the surroundings, not every occupation and profession, which may correspond to the masculine abilities, may be to the same extent adequate for women. Undoubtedly, there are activities, while fully in accord with the nature and physical constitution of men, are entirely unsuited for women. That means, that the question of equal rights for women must be decided with care, in strict accordance with the biological peculiarities of feminine nature. The absurd adoption of the rights for women, based not on the knowledge of biological laws, but granted entirely at will, may bring very little use to woman herself. It may destroy her spiritual being, hindering the de-

velopment of her natural abilities, and appearing in this manner a crime against woman herself. This should not be misunderstood. The author of these lines, as well as contemporary biologist, is not against equal rights for women. On the contrary, from biological data, women should be given far greater rights than are allowed by the most radical reformers. Moreover, in many branches, following the biological peculiarities of the feminine organizations, the woman should be given more rights than man, especially in those domains, where the feminine spiritual apparatus is more sensitive, finer and consequently, more competent than the masculine. And who knows? It is possible, that a series of the greatest human calamities might have been averted, if women at that time could have justly occupied the places in parliaments. Decisions for war would not have been made and approved with such an easiness and rapidity, as repeatedly took place in the masculine parliaments in the fatal year of 1914.

It is to be regretted how little thought we give to the fact that the masculine instincts and tendencies subconsciously find for themselves expression in the militarism of all times. Although the complicated contemporary problems of militarism seem to have nothing in common with these inclinations, nevertheless, they are the basis of antagonism and struggle, which throughout nature, are a secondary masculine feature. It is true, that parallel with the development of human culture, these instincts in their complicated manifestations escape our attention. But, if we should dig deeper into many contemporary phenomena, if we should approach these manifestations with a biological criterion and not with a purely psychological understanding or logical arguments, there would appear before our eyes a picture less complicated, more denuded, whose source and proto-type we may also find in the animal kingdom. The striking similarity between the purely external display, which militarism adopted for thousands of years, and the picture which we

observe in the animal kingdom, is certainly not accidental. Let us recollect the various ornamental military coats adorned with colorful ribbons and with enormous wavy plumes, head gears and all the other trappings, among all nations and during hundreds of years, and we will find a close biological relation with the designs and ornaments of the males, generally met with in nature as well as with the other secondary sexual characteristics, that are so richly distributed in the animal kingdom. These instincts of struggle, with the development of civilization have acquired entirely new forms; less concrete, more abstract, but their biological basis remains the same. The instincts of bloody struggles, reared in the male, not only throughout his human history, but also inherited from his animal ancestors, are in their nature strange to woman, who has been developing under the influence of the powerful instinct of a mother, creating in her a strong moral sense and love towards others. It is beyond doubt, that in deciding the question of war and peace, it would be safer to trust the fate of nations to a woman-mother, than a man antagonist. Not only in these exceptional moments, but also in many other branches of our social daily and governmental life, the woman should be occupying a more honorable place, especially, where an immediate moral estimate is demanded and not a logical reasoning perception.

However, it cannot be denied that a great deal should be excluded from the jurisdiction of woman. Money cannot be trusted to her psychical apparatus and man should have the preference in such branches of human civilization. It is difficult to imagine an ingenious stratagical plan, a deep logical analysis of complicated occurrences, an exact scientific mathematical account of manifestations on the part of woman. In our daily life, many other things should be excluded from her sphere of activity. A series of professions should be left principally to men, but guided of course, not by any other considerations than biological data. A series of other occupations and profes-

sions should be given to women with the same rights as men. Finally, guided again by the same biological reasoning, it would be rational to leave other work principally or exclusively to women. It seems that in general, it would be necessary to exclude very little from the competency of women, but even this limited amount should be excluded.

Of course, this is no place to enter into a detailed analysis of the biosocial problems. Especially, one should not make any premature conclusions, for the entire science of the so called biosociology is still in a rudimentary condition. However, beginning its development during the last few years, the new science discloses a tendency to a rapid growth and apparently the time is near when we shall demand from the sociologists, not a voluntary, accidental, and crudely based solution of the social problems, but we shall demand a biological account of all their actions and a careful analysis of the attempted reforms. Then the fate of society will pass into safer hands; then sociologists who are entirely ignorant in natural sciences will not be controlling the fate of millions of people. Particularly, the question of so called "equal rights" for women will change into another, a more critically formulated and biologically sounder question of a more rational and harmonious cooperation of men and women in the creation of greater spiritual treasures, known as civilization. Not an unnatural violent establishment of equality, but a further differentiation and perfection of natural peculiarities of men and women. Only by this close rational cooperation, may human progress be secured. However, this will arrive when biology will cease to be exclusively a laboratory science and the privilege of the chosen few. When it will penetrate into the wide circles of society, and will become general property. But all this is ahead of us. In the meantime, there is progressing quite slowly and unnoticeably, but with important significance, the process of accumulation of these important biological data, on which must be built the splendid structure of future biological

views. In this process the works of Steinach will undoubtedly occupy one of the most honorable places.

By that time may be realized mankind's most sacred dreams of rejuvenation and prolongation of human life. The achievement of this will mark for humanity one of the greatest victories it has ever had over nature and its laws. A victory still more important, because it is connected not only with material conquest, but with the very destiny of man himself, if any destiny can be ascribed to him in the general development of nature. I have in mind the process of spiritual creation. In order to estimate this thought correctly, let us remember that man usually perishes at a time when his spiritual strength is still in full bloom, when he can yet contribute a great deal, if his physical condition did not set a premature end to his activities. Let us remember that all the scientists, to whom the knowledge of the natural laws and the struggle with them in the name of human happiness was the only purpose of their being, died in the same manner. And what bitter irony lies in the fact that these warriors for human happiness were compelled to stop their work and pay their tribute to insatiable death at a time when they were at the height of their work, when it seemed humanity had a right to expect a great deal from them. Who can tell how far humanity could have gone in its development, if the best of its representatives had the opportunity to continue for a number of years the works, which they probably ceased at the most important and decisive moment. Or how much work went into the graves with their creators? They were not left to posterity in their entirety, for it is impossible to leave on a piece of paper all the richness of thought, all the nobility of wisdom and unexpressed ideas. Who knows, maybe the problem of rejuvenation and prolongation of life itself would have received the long desired solution, if death did not carry out so cynically its devastating work in the rows of the scientists.

We are approaching the end. Gradually there has unfolded before us one of the greatest conquests of human

genius. It is difficult at the present time to foretell the significance and the consequences of Steinach's works. Too little have we weighed their significance to estimate them even approximately. Only time will show the value of this new epoch created by Steinach.

Who will doubt the fact that one single conquest of science brought humanity a great deal more benefit and happiness that the "ideal" bloodsheds which have been carried on under the name of national and civil struggles? That diphtheria antitoxin saves from death more children than there are orphans left by these carnages; the discovery of salvarsan (606) saves more unfortunates than there are criminals created by those immeasurable butcheries; that the discovery of the tubercle bacilus promises humanity a great deal more happiness than all the national victories and political reforms, regardless of the quantity of blood they cost and the moral corruption they depend on. Evidently, different are the paths on which science travels for the achievement of its success, from the means employed by the national "heroes" and political leaders for the realization of their coveted aims. Science alone does not recognize these artificial human boundaries. It does not know people-friends and people-enemies. It does not build its success on human suffering and tears. There is only one enemy before it; horrible, powerful, insidious. This enemy is nature. Not nature the mother nature, affectionate, caressing as it is presented by poets, but nature, the step-mother, nature the wicked and merciless, carefully guarding her mysteries from the human eye. Only with the greatest difficulty, as a result of the most obstinate struggle, have we succeeded in solving one mystery after another and delivering it for use to man, who is succumbing in the unequal fight.

Difficult is the struggle, thorny is the path of science. It demands great sacrifices from those who enter it and devote themselves to the greatest mission-spiritual creation. In this respect Steinach's experiments are a new

achievement on the difficult road, a new victory of human ingenuity. Just at the time when Steinach's works are coming to an end, humanity is reminded of the fact that there is something more than mutual struggle and violence. Science irresistably lives and grows. Great are its victories, and boundless is its significance. Just at the time when humanity is enveloped by darkness, wickedness and senile decrepancy, Steinach's experiments with rejuvenation, symbolically call humanity forward to resurrection and creation. It is the guiding star, which will show us the path to a new prolonged and happier life.

Let us follow then this road!

With transtor's compliments

Dr. H. C. Penn

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